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ENGINEERING NEWS.

THE NAVIES OF THE WORLD are set forth as follows in the report of the United States Secretary of the Navy, including in the list all vessels built, building, or projected at the present time:

Country.	*Armored.*	*Unarmored.*	*Total.*
England	76	291	367
France	57	233	290
Russia	49	119	168
Germany	40	65	105
Holland	24	70	94
Spain	12	78	90
Italy	19	67	86
Turkey	15	66	81
China	7	66	73
Sweden and Norway	20	44	64
Austria	12	44	56

As noted in our last issue, the United States Navy, on the same basis, would possess 10 armored vessels, 13 single-turreted monitors, 21 steel cruisers, 2 dynamite cruisers, 7 iron steamers, and 1 torpedo boat. As a contrast to our weakness in torpedo boats Secretary TRACY gives the number of these boats owned by foreign States as follows:

Country.	*Torpedo Boats.*	*Country.*	*Torpedo Boats.*
England	207	China	25
France	191	Denmark	22
Russia	138	Japan	21
Italy	128	Sweden and Norway	19
Germany	98	Holland	16
Austria	60	Spain	15
Greece	51	Brazil	15
Turkey	29		

The Secretary, in view of "the defense of the United States absolutely requiring the creation of a fighting force," asks for a total appropriation for his department of $25,509,253.

THE HYDROGRAPHIC OFFICE of the U. S. Navy recommends, through its chief, Commodore J. G. WALKER, that an appropriation of $200,000 be set aside for a special building for his office. There are now nine branch offices, and others are recommended at all important points, not now supplied, on the seaboard and great lakes. Sixty-six new charts were issued in the year covering localities in Newfoundland, on the coasts of California, Mexico, Central America, and Alaska, and in the Pacific islands and East Indies. Great circle charts of all the oceans have been also prepared.

THE GUNS OF THE VESUVIUS MUST THROW DYNAMITE before Secretary TRACY will accept the vessel. In a letter to the Pneumatic Dynamite Gun Company he says that the ability to discharge the gun once in two minutes has been proven, but it is not yet shown that the guns on this ship can throw a shell containing 200 lbs. or more of dynamite at least one mile. It is also not yet shown that the contract requirement of 3,200 horse-power has been developed in the *Vesuvius*. Secretary TRACY requests that both these tests be made.

THE DRIGGS-SCHROEDER RAPID-FIRE GUN is said to have been sold to English capitalists for $600,000. This gun is the invention of two United States naval officers, Lieut. SCHROEDER, who commands the *Vesuvius*, and Lieut. DRIGGS, who has written much on ordnance matters. The advantages of the gun are light weight and rapid firing capacity. It weighs only 15 lbs. and can be discharged three times as fast as the Armstrong gun of like calibre. The American Government will, as usual, buy what it needs of these American guns of the foreign company.

SWEDISH ENGINEERS IN AMERICA met in Trenton, N. J., on Nov. 27 to the number of forty. They held a conference with the purpose of adopting some scheme favorable to a national engineering society, having for its purpose the advancement of Swedish civil and mechanical engineers now in this country. Mr. S. A. SUNDSTROM, of Philadelphia, presided.

THE HUDSON RIVER TUNNEL is progressing quietly. Last week the longest tunnel from the New Jersey shore was reported as being 2,025 ft. out. The New York tunnel is not being worked, and is about 200 ft. out from the bulkhead. About 100 men are at work, and rumor has it that a shield is being prepared which is to be pushed forward by hydraulic power.

SYDNEY, NEW SOUTH WALES, is to sewer its western suburbs at an estimated cost of $9,089,480, says *The Colonies and India*, which puts the figure at £1,817,896. The population of Sydney is now nearly 400,000; but the drainage is designed for a population of 750,000. The engineer is Mr. GEORGE H. STAYTON, M. Inst. C. E.

NEW ORLEANS, LA., wants a drainage commission; and a resolution is now before the City Council, asking that such a commission be appointed to consider and formulate a plan for the better drainage of the city. The commission is to consist of eight men, one of whom shall be a competent civil engineer, not at present connected with the city government, but well acquainted with all the conditions of the case. As these commissioners are to serve without compensation, they must find their return for some hard work in possible glory and public service.

THE LONDON WATER SUPPLY, according to the last metropolitan report, amounts to a daily total of 177,735,797 galls., divided among a population of 5,604,318, or a total of 31.7 galls. per head. The total number of houses supplied by the water companies was 755,850; a supply of 235 galls. per house per day. In the above total 371,090 galls. daily come from ponds and is used for non-domestic purposes.

THE MOST SERIOUS RAILWAY ACCIDENT of the week was a head collision Nov. 30 on the Old Colony Railroad at Providence, R. I., between the Stonington line steamboat express and a switch engine. One account states that the switch engine was standing on the track and was protected by the signals; but another account says that the signals were right for the express, and that the switch engine ran onto the main track in front of the train. One man was killed and two were fatally injured. This railway has been very free from serious accidents owing to its extensive use of the block signal and interlocking systems.——Both side-rods of a locomotive broke Nov. 25 while the train was nearing Green Castle, Ind.——A serious accident nearly resulted on the Air Line road near Portland, Conn., Dec. 1, through the carelessness of some trackmen. They were laying some new rails, and the place where they were at work was just below a sharp curve in the track. Around the curve a fourth man was stationed to warn them of the approach of trains, but for some reason he left his post temporarily. The men below had laid a rail directly across the track when a train was upon them. They managed to remove the rail when the train struck them, and the three men were hurled down an embankment and seriously injured. The train passed on in safety.

ANOTHER SERIOUS RAILWAY accident was the derailment of a freight train on the Iowa Division of the Illinois Central Railroad, near Aplington, Ia., Nov. 24. A bridge over a small ravine was being repaired, and a wild freight train, consisting of 35 loaded cars, pulled by two mogul engines, went through it. The danger signal had not been placed far enough from the bridge, and when the foreman saw the train he ran toward it, but the engineer, thinking he was flagging them on account of a hand-car that was on the track, did not reverse until it was too late. One part of the bridge was on jack-screws, and gave way after the first engine had passed over. The second engine and 15 loaded cars were piled up in the wreck. Two men were killed and four were injured.

A LANDSLIDE occurred Nov. 28 on the New York Central Railroad near Troy, N. Y.——The New Jersey Division of the Lehigh Valley Railroad was blocked Nov. 28 by a landslide at the mouth of its tunnel at Pattonburg which occurred while a coal train, with locomotive at each end of it, was passing. The slide came from a hill 100 ft. high and wrecked the boiler house and killed WILLIAM BIGLEY, who had charge of it. The timbers, boiler, and slide then fell against the train, wrecking 8 cars. The wrecking of the boiler and pipes caused the tunnel to fill up with water. While the wreck was being cleared a large number of unwrecked arching fell and came near killing several men. This arching must be rebuilt before trains can be run.

BRIDGE ACCIDENTS are reported as follows: the Chesapeake & Ohio Railroad bridge over the Guyandotte River near Huntingdon, W. Va., gave way under a freight train Nov. 27. One man was killed. The structure is said to have been condemned as unsafe.——The pontoon bridge recently built across the Missouri River at Leavenworth, Kan., at a cost of $40,000, was carried away by floating ice on Nov. 28.——The Central Pacific Railroad bridge over the Truckee River at Wadsworth, Nev., was burned recently. It was a wooden bridge, with a single span of 225 ft., and was built in 1869; it had a corrugated iron roof.——The Lake Shore & Michigan Southern Railroad wooden bridge (or trestle) across Spy Run, near Fort Wayne, Ind., was burned Dec. 2.——At Kansas City, Kan., a car on the Kansas City, St. Joseph & Council Bluffs road ran off the track under the Twelfth St. viaduct recently, and knocked down one of the iron pillars supporting the structure. It caused the viaduct to sink several inches, but it was soon propped with timbers.

A BROKEN AXLE on a Brooklyn Bridge cable car caused a delay of nearly three hours on Dec. 3.

HEAVY FLOODS have damaged the water-works at Exeter, N. H., and carried away the Longmeadow dam at Springfield, Mass.

THE SAN BLAS CANAL ROUTE, says Mr. FREDERICK M. KELLEY, the veteran Isthmian Canal projector, should be adopted by the Panama Canal authorities, and their own at once and forever abandoned. As explained by Mr. KELLEY to a New York *Tribune* reporter, this route is only 40 miles from the Panama Canal and is 30 miles long from ocean to ocean, while the total excavation is estimated at 40,000,000 cu. yds., as against 130,000,000 cu. yds. on the Panama route. The San Blas Canal would include seven miles of tunnel. But Mr. KELLEY, who has studied and surveyed this route since 1854, thinks that in this day of high explosions and improved tunnelling appliances this will not be an insurmountable obstacle by any means. He estimates the cost at $143,000,000, and thinks that it would cost less to build the San Blas Canal at the sea-level than to finish the Panama as a canal with locks. On the first-named route, the Atrato River will answer as a feeder, and excellent harbors already exist at the termini.

A SYSTEM OF MACADAMIZED ROADS was advocated at a meeting held at Jamaica, Long Island, on Dec. 4, under the auspices of the Queen's County Agricultural Society. The meeting was largely

attended by representative property-owners and farmers, and after discussing the various types of road covering, the macadam was adopted as best suiting the conditions. A committee was appointed to seek proper legislation and to urge upon the adjoining counties the importance of united action in this matter.

THE EGYPTIAN OBELISK IN CENTRAL PARK is fast being destroyed by the rigors of an American climate, despite the paraffine "preservative." Prof. EGLESTON, who read a paper on the disintegration of this monument before the Am. Soc. C. E. in 1886, concludes that housing it is the only thing left for the obelisk, and suggests putting it under the dome of the Museum of Art.

THE CONSTRUCTION OF RAILWAYS IN CHINA seems to be stopped, for the present at least. The fire in the Temple of Heaven and the necessity of borrowing foreign money for construction are the two levers that have been used to overthrow the scheme. Memorials on both heads have been sent in,—on the latter subject by Kuang-ti-Fang, an influential official, and on the former by comparatively insignificant individuals. Without a large foreign loan, railways are impossible in China. China should now direct attention to the opening of her coal and iron mines, which may be almost as important as railways. Her rivers and canals need attending to, deepening and embanking.

ON THE THIRD AVENUE HORSE-CAR LINE last year 1,725 horses (not counting cars, men, track, etc.) earned $1,586,328, an average of about $920 per horse. The receipts increased nearly 11¼ per cent.

OVERHEAD ELECTRIC WIRES in New York have been supposed to be made safe by "underwriters' insulation," the form approved by the insurance companies. The recent numerous accidents have caused it to be grimly designated as "undertakers'" insulation.

AUSTRALIAN FEDERATION.—Sir HENRY PARKES, Premier of the New South Wales Government, in a circular letter to the Prime Ministers of the Australian colonies, after pointing out difficulties in the way of the creation of a Federal army, gives in detail the objects of the convention recently proposed by him in a speech at Sydney. According to his plan a convention of delegates from the various colonies would be held for the purpose of constructing a Federal Government on the basis of a Federal Parliament. He further says that the scheme will necessarily follow closely the type of the Government of the Dominion of Canada, and adds that the delegates to the proposed convention will also be guided by the rich stores of political knowledge collected by the framers of the American Constitution and by others since their time.

PAT AND THE PUMPKIN VINES.—A correspondent writes that the account of the Swiss mayor's method of preserving stakes, mentioned on page 506 of ENGINEERING NEWS of Nov. 30, reminds him of a similar occurrence which he was personally cognizant of. A farmer who had just employed a newly-arrived Irishman, took him out into his cornfield and showed him how to hoe corn; and pointing out to him the young pumpkin vines, explained that he must be very careful to save them all; so when Pat came down to dinner he brought every one of the vines with him.

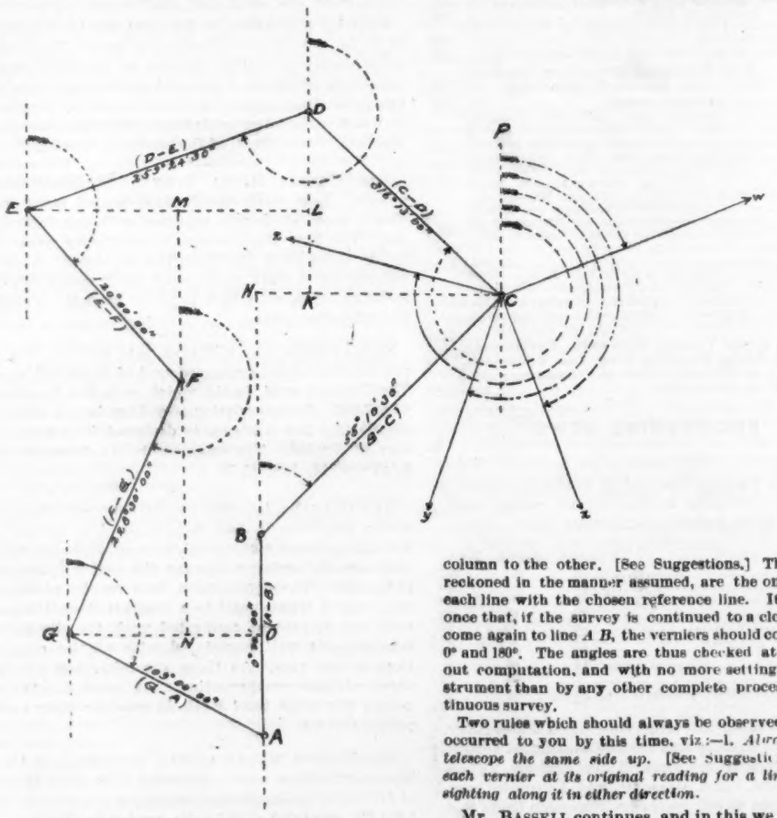
The story of the Swiss mayor reminds another correspondent of an incident that actually took place at Cleveland, O., a few years ago. Newburg was being annexed to that city, and the city surveyors were running out the lines of the new streets thus acquired. One day they failed to find a certain street monument, after spending an afternoon at hard labor in digging up a goodly portion of the street. The attention of the neighborhood was attracted by this unusual proceeding, and a good-natured citizen on returning to his home that evening was informed by his wife of the failure of the engineers to uncover the coveted monument. He took compassion on the boys and went for that stone himself. Next morning, just as the party was about to renew its search, in came the citizen, with the proud remark, of "Here's the stone you were looking for, I guess." And sure enough, there was under his arm!

Traverse Surveying.

A correspondent, Mr. BURR BASSELL, of Los Angeles, Cal., sends us a communication under the above head, proposing the system of keeping traverse notes illustrated in the accompanying cut. We regret that the communication is too long for us to give space to it entire, especially as we do not approve of some features of the method, but the following is a pretty full abstract of the article.

The proposed method is stated to be a modification of that taught at the University of Michigan by Prof. J. B. DAVIS, and the following quotations are made from a paper by him, read before the Illinois Association of Civil Engineers and Surveyors, January, 1883.

Running a traverse or traversing is conducting a survey in such a way that the readings of the plate will show the angle which each line of the survey makes with any chosen reference line, instead of the angle which each line makes with the preceding one. The former angle may be called the traverse angle of a line. The traverse angles will be reckoned from the reference line in right-handed rotation, through any number of degrees. Thus, in the cut, if *A B* is the reference line, the traverse angle of *B C* is *H B C*; of *C D* is 360° minus the acute angle *P C D*. At the other points the traverse angles are indicated by the dotted arcs. The graduations of the plate will be reckoned from 0° to 360°, running round to the right. The telescope will be kept the same side up during all the observations. [See Suggestions.]



Traverse Surveying; Diagram.

Directions.—Set the instrument at *B*. Back-sight toward *A* with the plate verniers reading 0° and 180°. Record these readings, each in its proper column in the note book, as in the table below.

Sights.	[B] Vernier I.	[A] Vernier II.
B to *A*	180° 10' 30"	0° 00' 00"
B to *C*	55° 10' 30"	235° 10' 30"
C to *D*	136° 13' 00"	316° 13' 00"
D to *E*	259° 24' 30"	79° 24' 30"

Take another look at the verniers and the back-sight to see that the instrument is exactly set. Unclamp the plate-clamp, and set the line of sight on *B C* by means of the plate-clamp and slow motion screw. Record the present vernier readings each in its proper column, opposite a note in the first column showing that the sight is from *B* to *C*. Unclamp the plates and turn again on the back-sight, to make sure that the plate readings are as when the plate was first set. Next back-sight to *B* with each vernier set at the same reading as when at *B* and fore-sighting on *C*. Unclamp the plates and set the line of sight on *D*, with the plate-clamp and slow-motion screw. Record the plate readings and then test the back-sight again as before. Move to *D* and repeat similar operations, using first the readings last obtained at *C*. Proceed in this way at will, measuring and recording all the distances from point to point when the instrument is set. If the line *A B* is not the reference line, set the verniers when starting at *B* so that one of them will indicate its traverse angle, and record these readings, noting which one is the traverse angle of *A B* [see Suggestions], then proceed as before.

Remarks.—These notes may be interpreted as follows: As the survey is assumed to proceed from *A* to *B*, to *C*, *D*, and so on, and as the traverse angles are reckoned to the right when one faces in the direction *A B*, we see very plainly that, if *A* to *B* is 0°, *B* to *A* is 180°; that in the first line, vernier II [*A*] indicates the traverse angle of *A B*; in the second line, Vernier I [*B*] shows the traverse angle of *B C*; in the third line, Vernier II [*A*] gives the traverse angle of *C D*, and so on, alternating from one column to the other. [See Suggestions.] These angles, reckoned in the manner assumed, are the ones made by each line with the chosen reference line. It follows at once that, if the survey is continued to a close, so as to come again to line *A B*, the verniers should come back to 0° and 180°. The angles are thus checked at once without computation, and with no more settings of the instrument than by any other complete process of a continuous survey.

Two rules which should always be observed may have occurred to you by this time, viz:—1. *Always keep the telescope the same side up.* [See Suggestions.] 2.—*Set each vernier at its original reading for a line whenever sighting along it in either direction.*

Mr. BASSELL continues, and in this we fully agree with him:

It will be observed that Prof. DAVIS would arbitrarily make any line of a survey he may wish the "reference line." Now if it be any other than a north and south or meridian line, he cannot call the traverse of a distance or the co-ordinate of a course its latitude and departure, hence he introduces in the latter part of the paper under consideration "fore and back traverse," "right and left traverse," according to the directions in which they extend with regard to the reference line.

"Traverse" is a term borrowed from navigation, and has a definite meaning. "Courses" in navigation and "bearings" in geodetic surveying are synonomous. Let us not unnecessarily mystify and corrupt our engineering nomenclature by substituting such expressions as "fore and back traverse," "right and left traverse" for "latitude" and "departure."

Why should we ever use any other than a meridian line (true in preference to magnetic) for the reference line? All survey lines should be cardinally referenced, that is should have their true bearings established, whether they be township, range, or section lines, railway tangents, patent boundaries, meander lines, streets on the base line of a system of triangulations.

I would take exception to the first rule given, as to the manner of using the transit. One great advantage of our present make of field instruments is that the telescope will revolve on a horizontal axis, making the instrument a transit in fact as well as in name. The usual manner of using the transit, as all know, is to back sight, clamp the limb, revolve the telescope in its standards, unclamp the plates, fore-sight to object by deflecting right or left as may be necessary, and record the de-

flection angle. Thus, it would appear that a back-sight in the use of the transit means a sight on some preceding station or point (previously located) with telescope inverted or the level-side uppermost. All other sights are fore-sights with the telescope right side up. This distinction between back-sights and fore-sights in the use of the transit is analogous to that in the use of the Y-level, where a back-sight is the first sight or reading of the rod taken after setting up the level to obtain its elevation, and all other sights from the same place are fore-sights without regard to direction of sight. Possibly there are those in the field to-day whose instruments are permitted to remain so much out of adjustment for collimation (through ignorance or laziness) that the traverse system of surveying as herein described would be practically useless. This system will be antagonized by all that class, unless they lack the courage to affirm that our best instrument makers have signally failed to meet the essential requirements of a transit.

Mr. BASSELL then states that making use of the cut herewith, and the notation already given, his note book would appear as follows; and in this and what follows we are unable to so fully agree with him:

Transit Points.	Vernier *A*.	Vernier *B*.	Vernier Dist.	Remarks.
At *B* △	0° 00′ 00″	180° 00′	*A* — *B*	Back-sight (Bs.) on Sta. A.
	55° 10′ 30″	235° 10′ 30″	*B* — *C*	Fore-sight (Fs.) on Sta. C.
At *C* △	55° 10′ 30″	235° 10′ 30″	*B* — *C*	Bs. on Sta. B.
	79° 24′ 30″	259° 24′ 30″	*C* — *w*	Fs. on *w* (describe object).
	140° 30′	320° 30′	*C* — *x*	Fs. " *x*
	220° 30′	40° 30′	*C* — *y*	Fs. " *y*
	280° 00′	100° 00′	*C* — *z*	Fs. " *z*
	316° 13′	136° 13′	*C* — *D*	Fs. on Sta. D.
At *D* △	316° 13′	136° 13′	*C* — *D*	Bs. on Sta. C.
	259° 24′ 30″	79° 24′ 30″	*D* — *E*	Fs. " " E.
At *A* △	109° 30′	289° 30′	*G* — *A*	Bs. on Sta. G.
	0° 00′	180° 00′	*A* — *B*	Fs. " " B. (Pt. of beginning)

These notes scarcely need any explanation. The survey began at Station *B*, and the course *A*—*B* happened in this instance to be a north and south line, and hence coincided with the "reference-line." Had it been otherwise, it would simply have been necessary to determine the traverse angle of said first course and proceed as already shown.

At Station *C*, bearings and distances were taken to several objects (*w*, *x*, *y* and *z*). After locating Station *C* on the map by means of its latitude and departure (algebraic sums, as given in the office-rabling), these several objects may be readily platted by using a large paper protractor.

In the field-work I would make one vernier—the *A*-vernier for instance—always record the traverse angle, while the *B*-vernier be used solely as a check on the *A*-vernier reading—being the same ± 180°.

By "traverse angle" is meant what may be termed the cardinal traverse angle or the angle measured to the right from the north or meridian reference-line. It will be observed that in following Prof. DAVIS' instructions to keep the telescope of the transit the same side up, the *A* and *B* verniers alternate in recording the traverse angle and necessitate a similar irregularity in the field-notes. This is liable to create confusion and is a fruitful source of error, especially when the notes are put into the hands of draughtsmen unacquainted with the field.

The same check upon the correct measurement of angles without computation, pointed out by Prof. DAVIS, is equally applicable to this method, with the additional check, that on dropping the needle at any point in the survey, it should point to 0° or true north, if its variation be set off on the compass box. This does away with the usual reductions and computations, greatly lessening the liability of error. In the case of a boundary survey where a summation of the interior angles is desired, the following rule will give the interior angles without further instrumental work.

RULE.—Any interior angle is equal to the difference between the *A*-vernier readings of the sides forming that angle ± 180° (as the interior angle required should be greater or less than 180°).

The right-hand page of the note-book may be used for remarks, describing the objects located or for sketching. One advantage the traverse system possesses over the old is that the field-notes do not require a complex diagram showing a network of lines and angles. Topographical surveys and much municipal work, however, require a sketch explanatory of the description notes.

Our opinion is that no form of closed survey with very large deflection angles can be made to advantage without an accompanying sketch, but independently of this we object still more strongly to the rather back-handed method of handling the angular notes herein proposed. In referring all angles to a constant north and south line (either actual or assumed, it makes no great difference) it is admirable; but why deviate from the old and familiar system of bearings running from north or south for 90° each way to east or west? These must be used in any case for conveniently working the traverse, and they should be so recorded from the first.

The true method of doing field-work of this kind is this: Set up on the first station with the vernier at zero. Unclamp below, drop the needle, turn so that it reads nearly north, clamp again, and with the lower tangent screw bring the needle also to read exactly zero. If the transit be constructed so as to set off the variation, the needle may be set to read bearings from the true north line; otherwise the magnetic north should be used for both vernier and compass.

The instrument being thus set, unclamp above and fix on the next station as a fore-sight. This causes both vernier and needle to read the same, viz, the bearing or angle of the line with the magnetic or true north, except that the vernier readings in the two south quadrants will have to be subtracted from 1.80°. If desired, we may, before removing, unclamp above again, and take sights on a dozen other points in different directions, in all of which sites the vernier and compass readings will correspond, the compass checking against large errors; the vernier giving precision, and in all cases the vernier readings being recorded as bearings. This also saves occasional errors in recording the direction of angles, or whether they are interior or exterior.

The last sight before removal must in any case be on the next station, so that the vernier and compass in removal will read the bearing of the line. Keep them so; and after setting up on the next station, unclamp below, release the needle, see that the vernier still reads as at the last station, take back-sight on the latter, revolve the telescope (or not, as preferred), unclamp above, and the transit is now again ready to take identical compass and vernier readings in any direction; as it will be, continuing the same process, on a hundred successive points, at no one of which is the vernier ever reset, unless it chances to have been accidentally disturbed.

If plotting a multitude of very short courses, the latitudes and departures furnish the best methods, especially if a large diagram be constructed to read off latitudes and departures from, graphically. If plotting such a survey as that shown in the cut, however, the bearings furnish the best method, pricking off all the bearings at once from a large paper protractor placed at any outside point as *C*, and transferring them one by one to where they are wanted a by large, heavy brass parallel ruler about 18 ins. long. The ordinary light and cheap parallel rulers are of no use for this purpose.

All that has just been stated is so well settled by practice that we do not understand it to be any longer open to question or dispute. Those who use any other method are simply flying in the face of experience.

THE CONNECTICUT RAILROAD COMMISSIONERS have made their first decisions under the new grade crossing laws. The first was the New England Central & Western Railroad, and the Consolidated Railroad at Simsbury. They order an overhead crossing, and the town is to pay one-quarter, and each railway company one-half of the remainder of the total expense. At "Nigger Elbow" crossing, they order an undergrade crossing, 20 ft. in width and 13 ft. high. The total expense is not to exceed $2,000, and the town is to pay one quarter, and the company the balance.

The Manufacture of Slag-Cement.*

The manufacture of cement from slag has, in the last few years, become rapidly extended, and works are now in operation in France at Saulnes and Marnaval, in England at Middlesbrough, in Switzerland at Choindez, at many places in Germany, and at Bilbao in Spain. The quality of the cement varies considerably in accordance with the composition of the raw products employed, and the care exercised in the manufacture; but the material when well made will bear comparison with the best Portland cement. The slag employed should be basic, and must be previously granulated on the system of Mr. C. WOOD, as otherwise it is devoid of hydraulic properties. According to Prof. TETMAJER, of Zurich, the lime, silica, and alumina in the slag should bear to one another approximately the following proportion, as 46, 30, 16. Fat or pure limes are generally selected to add to the slag, but the author counsels the adoption of poor or clayey limes, in cases where the cement is to be used above ground. Where much calcium sulphide is present, as in the Bilbao slags, the cement takes a greenish tinge, but this does not impair its quality. A sample tested by Prof. TETMAJER, composed of 100 parts of Bilbao slag and 15 parts of lime, was found on analysis to give the following percentage results: silica 30.56, alumina 13.31, oxide of iron 0.25, oxide of manganese 1.74, oxide of lime 45.01, magnesia, 2.96, sulphate of lime 1.41, and sulphide of calcium 4.63. Briquettes of the neat cement were tested as follows:—

	7 days.	28 days.
Strength in compression per square centimetre	Kilograms.	Kilograms.
In water	96.9	120.9
In air		144.0
Tensile strength per square centimetre		
In water	19.3	28.7
In air		19.5

The mode of preparing the slaked lime and the apparatus used for the purpose is explained by reference to diagrams. Drawings are given of various descriptions of drying machines which have been employed for desiccating the granulated slag; the rotary dryer, invented by Mr. RUELLE, is preferred by the author, and a novel form of apparatus, patented by Mr. RATY, of Saulnes, is described and fully illustrated. For the intimate admixture of the slag and slaked lime, and for grinding the same to a fine powder, the apparatus of Mr. LUTHER, of Brunswick, is employed. This consists of an iron cylinder with a corrugated lining, partly filled with small metal balls, by means of which the materials are both ground and mixed in one operation, which lasts about three quarters of an hour for each charge. The cement thus prepared leaves a residue of from 5 to 6 per cent. on a sieve of 2,500 meshes per square centimetre. A sample of slag cement made at the Donjeux factory was officially tested at the Écoles des Ponts et Chaussées in September, 1888, with the following percentage results: combined silica 23.85, alumina 13.95, peroxide of iron 1.10, lime 51.40, magnesia 1.95, sulphuric acid 0.45, sand 0.25, loss on ignition 7.05. It left on a sieve of 5,000 meshes per square centimetre a residue of 23 per cent. gauged with 28 per cent. of water, the initial set took place in one and a quarter hour, and the set was complete at the end of three hours. On the mean of six tests the neat cement showed the following tensile strength per square centimetre: in 7 days 21.87 kilograms, in 28 days 26.88, and in 84 days 31.15 kilograms (equivalent per square inch to 311.06 lbs., 382.32 lbs., and 443.05 lbs. respectively). Briquettes of 3 parts sand to 1 cement broke in 7 days at 14.93 kilograms, in 28 days at 26.03, and in 84 days at 29.33 kilograms (equivalent per square inch to 212.35 lbs., 370.23 lbs., and 415.74 lbs. respectively). Tables too long for abstract indicate the composition of twenty-three different samples of slags from various foreign furnaces, together with tests of the cements made from the same.

An estimate is given of the cost of the plant for a work capable of producing 6,000 tons of cement per annum, and of the necessary materials for the same, also of the expense of manufacturing the cement and the profits on the manufacture. The estimate is accompanied by plans and sections of the factory.

*By J. GROSCLAUDE in *Annales Industrielles*, July 21, 1889, as translated in *Abstract of Papers*, Inst. C. E.

A New Recording Pressure Gauge.*

In designing the recording pressure gauge herewith illustrated, the object was to produce an instrument which would be fundamentally simple and consequently reliable, and which could be placed upon the market at a moderate cost.

Fig. 1 represents the instrument complete and ready for application. Fig. 2 shows the pressure tube with the inking pointer attached; the front of case, dial, and cover of clock being removed. The pressure tube *A* is of flattened cross-section, and bent into approximately a sinusoidal form. A flexible strip *B*, of the same metal as the tube, is secured at the ends and along the bends as shown in Fig. 2.

The bent tube may be considered as a series of Bourdon springs placed end to end.

Pressure applied to the tube produces a tendency to straighten each bend, or collectively to elongate the whole. This tendency to lengthen the tube is resisted by the flexible strip *B*, and thereby converted into a multiplied lateral motion. The inking pointer is attached directly to the end of the pressure tube, as shown in Fig. 2, from which it will be seen that the usual mechanism and multiplying devices are dispensed with, since the motion of the tube itself is positive and of sufficient range. The special advantage of this is evident, considering that in all other pressure gauges, the movement of the tube or diaphragm is small, and requires a system of mechanism to multiply the motion many times before it is available for indicating purposes. These multiplying devices must be delicately constructed and properly cared for, and even under the most favorable conditions they are liable, at any moment, to be a source of error.

In the instrument illustrated, the tube is designed for a range of 180 lbs. per sq. in.; for other ranges its sensitiveness may be varied at will by changing its proportions, as length, shape of cross-section, or thickness. The printed charts for receiving the record make one revolution in 24 hours, and are provided with radial arcs and concentric circles, the divisions on the radial arcs corresponding to differences in pressure; while those on the concentric circles correspond to the hours of the day and night.

During the past year and a half, several of the instruments have been in operation upon the steam boilers at Stevens Institute, and have given perfectly satisfactory results.

In regard to making the tubes alike, it will be well to state that there has been no difficulty in producing a number in which the deflections were equal for equal pressures, and which have been directly applied to a standard chart, without adjustment. It will be readily seen that, in case there should be slight differences in the deflections, such differences may be allowed for, by raising or lowering the tube with reference to the dial. This is equivalent to shortening or lenthening the deflections along the radial arcs. For an indicating instrument it is only necessary to provide a graduated arc for the end of the tube to move over.

It is evident that the instrument is adapted for a vacuum as well as for a pressure gauge, and it naturally follows that, if sufficiently sensitive, it will serve as a barometer, and measure changes of atmospheric pressure.

The model herewith exhibited for this purpose was made by electro-deposition of nickel upon a piece of solder of the proper form; the solder being, afterward melted out in oil. The walls of this tube are 1-500 in. thick. When this tube is exhausted of air and sealed, as shown, it gives a deflection of about 3¼ ins. for an external change of pressure of one atmosphere.

Another application of the pressure tube is in the recording thermometer.

The tube may be filled with a very expansible liquid, such as alcohol, and sealed. Variations in temperature produce expansion of the inclosed liquid, which in turn gives deflections of the tube to correspond.

These deflections may be used to record directly, without multiplying devices, as shown in one of the models.

The tubes of the pressure gauges to be inspected have been made by the writer at Stevens Institute, for the purpose of thoroughly testing the novel form. The results have been perfectly satisfactory and our recent experience in manufacturing has demonstrated the possibility of duplicating the tubes in quantities for a standard chart.

* A paper read by W. H. BRISTOL, of Hoboken, N. J., before the American Society of Mechanical Engineers.

The Colorado Canon Survey.

The party under charge of ROBERT B. STANTON, Chief Engineer of the Denver, Colorado Cañon & Pacific Ry., started on Monday of last week to complete the survey through the lower part of Marble and Grand Cañons, in continuation of the survey whose full results we chronicled Sept. 21, 1889.

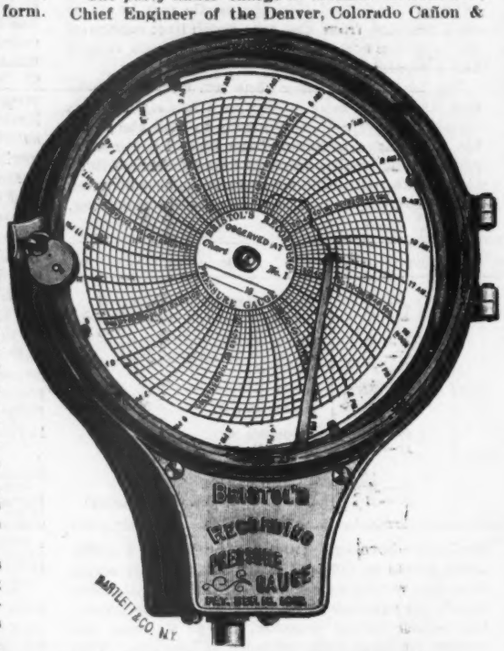


Fig. 1. Bristol's Recording Pressure Gauge.

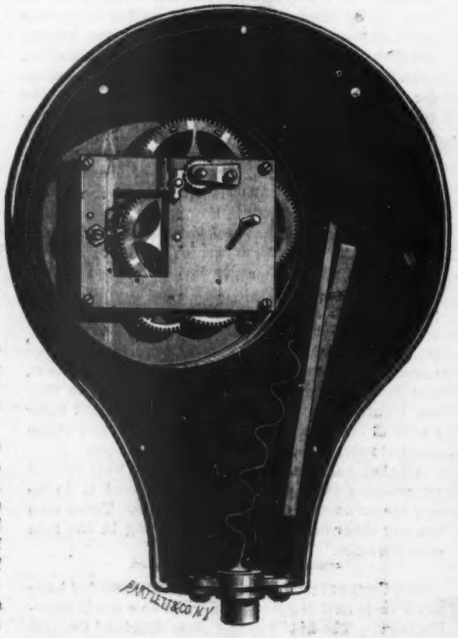


Fig. 2. Bristol's Recording Pressure Gauge; View Showing Interior Mechanism.

As the previous outfit proved inadequate for the requirements, and so resulted in the lamented death of President BROWN and two others of the party, great pains have been taken to make this one complete. Three boats are used, 22 ft. long, 22 ins. deep, and 4½ ft. beam, built of heavy oak, the sides matched in the Whitehall style and clinched to the oak ribs with copper rivets. They were built at Waukegan, Ill., by the R. J. Douglas Co., and contain each eight separate air-tight compartments. They are modeled after the United States life-saving boats, and the keels are constructed especially for bearing loads that will steady the boat from toppling. In the construction of the keel Mr. STANTON manifested considerable ingenuity in saving weight. Instead of having the weight on the keel placed on the bottom edge of it, a narrow strip of decking is placed in the bottom of the boat, between which and the upper edge of the keel are stored cans of provisions. Thus he has provided for loading the keels and carrying provisions, too. In case of the loss of all other provisions, if the boats be saved, a supply of food will be secured to preserve life.

To insure against loss of life, each man will be supplied with a U. S. life-saving-station life-preserver, the wearing of which at all times upon the river will be rigidly enforced, without reference to whether the conditions be considered dangerous or not.

The expedition will be supplied with all of the necessary engineering apparatus and tools for the repairing of boats. Three complete photographing outfits will be taken, and it is the intention to take not only photographs of scenery, but a panoramic view of every foot of the entire line, from one end to the other.

All clothing, the provisions, and all things perishable will be packed in waterproof, mackintosh, navy bags, made from a pattern furnished expressly for the expedition, which will be placed in lockers and the central compartments of the boats, made expressly for that purpose. Covering the entire storage will be a heavy tarpaulin, strapped to the bottom of the boats, so if one upsets, the sacks are held in place, and even after remaining in the water many days can be recovered undamaged. If a boat be smashed to pieces, there is enough air contained in the sacks to float them. The boats cost about $350 each.

The survey will cover 65 miles of Marble Cañon and about 200 miles of Grand Cañon, and is expected to occupy two to three months. It was deemed advisable to keep the party for this first exploring survey as small as possible, and including Mr. STANTON the crew will be made up of only twelve men, as follows:

ROBERT B. STANTON, Chief Engineer; JOHN HISLOP, Assistant Engineer; F. A. NIMS, Photographer; HARRY MCDONALD, Head Boatman; LANGDON GIBSON, ELMER KANE, REGINALD TRAVERS, JOHN B. PROBST, A. B. TWINING, H. G. BALLARD, JAMES HOGUE, cook.

We shall await with interest the results of this bold and adventurous survey for a project which seems to us to have many strong points in its favor, and will duly communicate the results to our readers.

Railway Ties in Germany.

Consul PARTELLO, of Dusseldorf, reports the recent convention of German iron masters and mining engineers. The subject of the relative merit of iron and wooden ties was discussed. Iron ties have been in use in Germany since 1875, commencing with the Bergisch-Markisch and the Rhine railway lines. The Prussian lines have been supplied with 622,000 new iron sleepers in 1886; 522,000 in 1887, and 493,000 in 1888. There has been, however, slight increase in the use of wooden ties—from 1,507,000 in 1886 to 1,657,000 in 1888.

The State last year appropriated 9,000,000 marks (about $2,250,000) for wooden ties and 4,000,000 marks (about $1,000,000) for metallic ties. It is estimated that the yearly import into Germany of wooden ties amounts in value to $450,000. Herr SCHLINK, of Muelheim, was of the opinion that the present German iron tie was too light, the general weight being 88 lbs.; he thought they should weigh at least 132 lbs. He also advocated heavier rails. Herr VAHLKAMPF quoted statistics to show that iron ties were about 10 per cent. cheaper than wooden ties, after deducting the value of the old metal. He estimated the life of a wooden tie at 15 years and that of a metal tie at 30 years or more.

An Empirical Formula for Chimney Area.

An empirical formula for determining the area of chimneys, and a diagram deduced from it, have been prepared by Mr. E. M. HUGENTOBLER, M. E., Engineer of the Abendroth & Root Manufacturing Company, of this city, and the following brief explanation is taken from the excellent trade pamphlet issued by that firm and elsewhere noted.

The author distinctly states that this formula is empirical; but it is computed from actual data and is based upon the fact that the areas of two chimneys of equal capacity should vary inversely as the square roots of their respective heights. But instead of the usual practice of allowing a certain annular space about the perimeter to compensate for friction, he has introduced a constant factor, which is to be deducted from the height of the chimney in feet. This formula, which has been found by experience to be correct enough for all practical purposes, is as follows:

$$C = \frac{201}{\sqrt{h-8}}$$

Here C represents the actual number of square inches which the cross-section of a chimney of h height (reckoned in feet above the line of grate) should contain for every square foot of grate surface in the boilers attached. This value of C, as here found, and as shown graphically in the diagram, is, if anything, a trifle larger; consequently any error will be on the safe side. The 8 ft. deducted from the height of the chimney compensates for skin friction.

This rule is given with the caution that wood and free-burning fuel require less draught than slack coal or screenings, and that, of all steam fuels, anthracite screenings require the greatest intensity of draught. Consequently the formula and the diagram must be used with some judgment, and with a due regard for the character of fuel to be employed. Mr. HUGENTOBLER states in this connection that it is not advisable in practice to make a chimney less than 80 ft. high above the grate, nor, as a rule, to exceed 200 ft. in height, this being amply sufficient to burn anthracite slack. The height of the chimney having been determined by the grade of fuel, the area is determined by the amount of fuel to be consumed and the volume of gas to be handled.

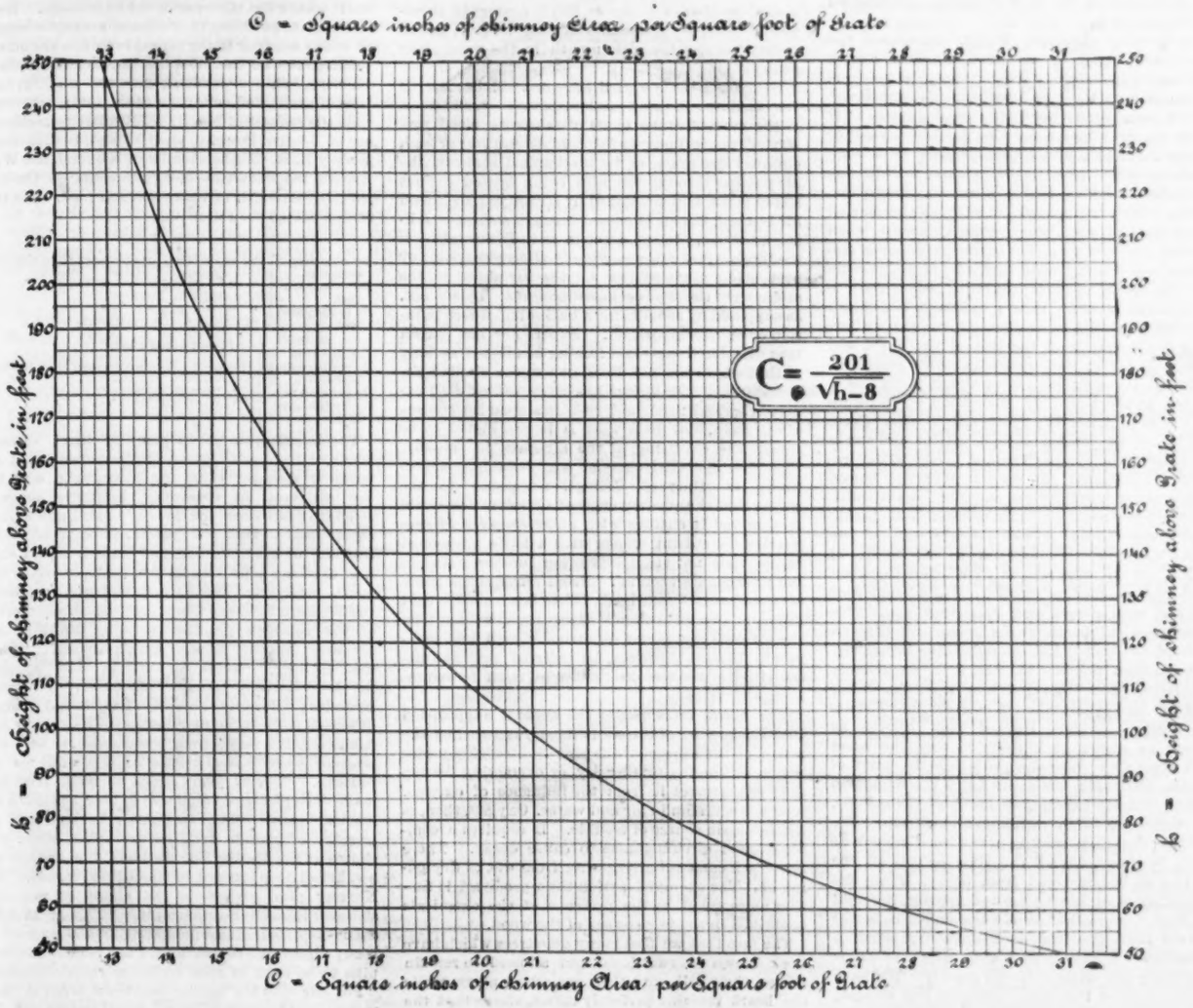

C = Square inches of chimney area per Square foot of Grate
Height of chimney above Grate in feet
h
$C = \frac{201}{\sqrt{h-8}}$
C = Square inches of chimney area per Square foot of Grate

Table of Chimney Proportions.

Comparative Value of Heart and Sap Pine.*

(Concluded from page 510.)

The strength of any wood is independent, however, of its specific gravity. There seems to be no relation between the two. For example, one of the census samples of *Pinus mitis*, has a specific gravity of 0.6516, an ultimate transverse strength of 507, while one of the samples of *Pinus palustris*, with specific gravity of 0.9823, has an ultimate transverse strength of 350. The specimens which were boxed or scarfed, and which showed an increased weight in consequence, showed that they had maintained their strength, in fact, they had increased in strength. This was not true of untapped heart pine. In these there were no concomitant variations in weight and strength. There has of late been considerable demand by the railroads for what they call "scarfed pine ties," that is, ties on which the scarf of the tree is visible on the ties. This is simply a demand for ties whose pores are filled with resin that has been concentrated in process of getting turpentine. The writer has been told by an official connected with the Atlantic & North Carolina Railroad that there is a tie in their road which has been there since the road was built, over thirty years ago. It is a sawn tie of scarfed pine. And in this connection it is well to consider if we engineers do not put too much stress on hewing ties, instead of sawing them. The pores on the surface of the wood are closed by a sharp broad-axe, but a dull one in the hands of a novice sometimes notches the ties, so as to make the notches a receptacle for water. If more care were exercised in specifying the nature of the wood, and less care as to whether or not the ties are to be hewn, we would have ties of more uniform surface, and the writer believes they would prove equally durable.

So much for that part of engineers' specifications which pertains to lumber being untapped. Shall we demand Georgia pine, or do we simply mean to call for long leaved pine? In the experiments made by the census officials, specimens of long-leaved pine were tested from almost every State from North Carolina to Florida. The tests demonstrate that, so far as strength is concerned, there is no advantage in long-leaved pine from Georgia over that from North Carolina or from any of the other States. This prejudice in favor of Georgia long-leaved pine is probably occasioned by the fact that in North Carolina the forests are almost always near forests of *Pinus rigida*, and in the early history of the shipment of this wood from that State to the northern market, much *Pinus rigida* was mixed with th

* Written for ENGINEERING NEWS by RICHARD LAMB, C. E.

same. An order given to any of the responsible manufacturers of *Pinus palustris* timber in North Carolina for a bill of that wood strictly, would get as good timber as if ordered from Georgia. But when we order Georgia pine, do we get it from that State? The following long-leaved pine was cut during the year 1880:

North Carolina	108,411,000 ft.	Alabama	245,396,000 ft.
South Carolina	124,492,000 "	Mississippi	108,000,000 "
Georgia	272,743,000 "	Louisiana	61,882,000 "
Florida	208,054,000 "	Texas	66,450,000 "

Out of 1195,428,000 ft. B. M., Georgia, contributed only 272,743,000 ft.

The Roman historian, PLINY, considered the resiniferous wood as the most durable. If a wood has in it sufficient resin to keep it continually dry, it is in the best condition to resist decay. But are resiniferous woods the most durable? If so, how do we account for the greater durability of cedar, juniper, and cypress, which have comparatively little resin in them over resiniferous pine trees? Coffins found near St. Augustine, Florida, which were made of cypress and buried over a century ago, were perfectly sound when exhumed, although all the copper and brass fastenings had entirely disintegrated. It is possible that the secret of the durability of cypress is that it keeps moist. It is a fact that if a board be placed vertically in a receptacle, for years afterwards the receptacle at the foot of the board will be kept damp by the moisture that percolates downward through the pores, which moisture is replaced in the board by absorption of moisture from the air. A wealthy gentleman of Glen Cove, Long Island, has built a large, beautiful, and costly villa entirely of cypress lumber. The writer recently accompanied the owner over the house, and examined critically the mortices, door-jambs, sills, wainscoting, floors and ceiling, both inside of the house where it was heated, and on the porches where it was exposed to all kinds of weather. In no case was it found that the wood had shrunk, warped, or swollen. It had remained as it had been placed over four years ago. This cypress wood weighs about six pounds when green and about two and a half pounds when kiln-dried. The gentleman referred to, who is a remarkably well-informed and observing man, told the writer that after an acquaintance of a great many years with cypress, he had learned that it was as well not to season or kiln-dry it, that the wood would regain its natural equilibrium in point of moisture, absorbing the same from the dampness in the air and not exhaling as much as it absorbed, thus remaining in an unchanged condition. We find, then, that if the nature of the wood is such as to keep it either dry all the time or wet all the time, it will be preserved from decay. From the above example of heart-pine and cypress, it would seem that a wood that is always moist is better preserved than one that is always dry, while a wood whose condition is such as to admit of alternate wetting and drying decays rapidly. We have examples of wood that have stood the test of ages, being kept dry under the sheltering roofs of old cathedrals; but we find much older specimens of long-lived wood in the form of dwellings submerged by lakes in Bavaria and Switzerland, which are at least 10,000 years old. A cypress has been found with over 3,000 rings, representing the same number of years, which, though submerged, had only in part been turned into brown coal. In the Dismal Swamp, cypress lumber for making shingles is mined from the moist, boggy soil—tree lying upon tree—and the whole covered with moist vegetable matter or peat. These logs are as solid and sound as the day, centuries ago when they fell in the positions as found. Seasoning timber by submerging it in water, although a longer method than others, is one of the most efficient methods employed. In England, lumber to be used for threshing-floors and wainscoting is laid in fresh water for several weeks. After being thus seasoned and allowed to dry, it will maintain its dimensions under varying temperatures, if not exposed to damp, and will endure for a very long time. Seasoning lumber under water is accomplished by the dilution and final washing out of the sap. It is a common belief that trees cut when vegetation is at rest are found to make more durable lumber. This is a fallacy. The time that vegetation is most at rest is during September, October, and November when the sap is "up," and it is not advisable, in consequence, to cut. The time which is universally accepted as most favorable for cutting timber is from the first of December to the middle of March, and in the month of July. The former is the preferable time. This is, when there is the least amount of sap in the trees, and the wood, therefore, requires less seasoning. Accompanying this paper the writer furnishes a graphical analysis of the rise and fall of sap in trees of the wood *Pinus mitis*, drawn from data furnished by Messrs. LAMB & BELL, dealers in short-leaved pine, from weights of that lumber, as per railroad scales, for each month in the year. (See page 510.)

Heat alone is not a good seasoner. Moist, hot, or very cold air, in rapid motion, passed over lumber, is the most effective mode of seasoning wood rapidly. This is done by kilns using natural or high chimney draughts, or by mechanical blowers, the air passing through the kiln being heated by hot steam pipes, and moistened by steam jets, or if cold air is used, the air is passed through a sheet of falling ice water. In some woods, as in *Pinus mitis*, if the lumber just after sawing is allowed to heat, by preventing a circulation of the air about it, the albumen of the sap becomes discolored. This is not, as supposed by some to be, a beginning of fermentation or of decomposition. Experience has shown that discolored sap-wood lumber has lasted as long as that which was not discolored under similar circumstances. The writer has corresponded with expert arboriculturists and chemists upon the subject of sap stain, and finds that it is considered to be simply the oxidizing of the albumen in the sap. One distinguished chemist and botanist, a professor at Harvard College, suggested to the writer that the phenomenon of discoloration could be observed in cutting with an axe a piece of sap-wood, as in cutting an egg with a knife. Seasoned lumber does not stain, but often lumber stains in the process of seasoning. From an analysis made of sound and decayed oak, it has been shown that for every two equivalents of hydrogen oxidized by the air, one equivalent of carbonic acid had separated. It may, therefore, be inferred that the decay or rot of timbers does not arise from fermentation.

The above facts refute the general supposition that the rotting of timber is merely induced by the action of the oxygen of the air. Submerging under water, or keeping lumber dry, or extracting the sap does not protect it from the influence of oxygen, which is common in air and water. Oxygen, then, is not the main source of trouble. It requires a combination of circumstances to cause decay. There must be a constant alternating from wet to dry going on. The chemical action thus produced is further augmented by the presence of the chemicals contained in the juice or sap of the wood.

The fact that we find many pine trees which have been blown or cut down and allowed to remain where they fell, with their sap rotted away, while the heart remains perfectly intact, shows that the sap-wood has but little it any influence in decaying the heart. It is an odd fact, however, that we often find trees which have remained standing with their hearts almost entirely rotted away, while the sap-wood still remains intact. This is very often the case with gum trees. The sap-wood is the artery of the tree. Hence we find trees girdled, or cut entirely through the sap, completely around them, when settlers are killing trees before clearing forest for cultivation of the land. The heart of a tree is the part that contains the most defects—knots, shakes, splits, dot, hearts, or pith are most frequently fonnd in the heart of a tree.

The sap wood of a tree, as a rule, seldom contains any of these defects, but it has the defect of being the receptacle for the deleterious sap. But unlike the defects common to the heart of the tree, which cannot be eradicated, this defect can be and is nearly always extracted from the lumber by seasoning. When we consider of the nature of the defects that are common to the heart of the pine tree, we see some of the reasons why seasoned sap-pine is stronger than heart. The more fibrous nature of the sap-wood is another reason why it is stronger than the heart. This statement contradicts the deductions as given in the table (see page 509) compiled from Government tests. But out of the specimens of long-leaved pine tested, there were three which were less strong in every way than the weakest of the specimens of short-leaved pines, seven that were weaker in every way than the next to the weakest sample of short-leaved pine, and fifteen specimens less strong than the strongest of the short-leaved. There were twenty-seven specimens of long-leaved pine tested, and only three of short-leaved pine. If the seven specimens above referred to were all that had been tested of the long-leaved, and the two strongest all that had been tested of the short-leaved, the result would have shown the short-leaved the stronger of the two woods. Hence the relative positions in the list of average strengths of woods, as given in the census report, as the officials themselves who compiled the same state, is due to accident, being dependent upon the quality, direction of grain, and condition of the samples tested.

At the request of Mr. G. W. RHODES, Superintendent of Motive Power of the Chicago, Burlington & Quincy R. R. Co., the chemist of the road, Mr. W. L. BROWN, made a series of experiments on the comparative strength of heart and sap pine. The tests demonstrated the following:

In Green Pine.

By compression test	the sap is 509⅛ lbs. stronger than the heart
By tension test	" " " 2814½ " " " " " "
By transverse test	" " " 57⅛ " " " " " "

In Seasoned Pine.

By compression test	the sap is 1,279 lbs. stronger than the heart
By tension test	" " " 3443½ " " " " " "
By transverse test	" " " 390 " " " " " "

The experiments go to prove by three different kinds of tests, both green and seasoned, that sap-wood is stronger than the heart, and also that the sap-wood in seasoning increases more in strength than does the heart. Mr. BROWN in his report states that an expert, some time before the date of his reporting, had made a report showing that sap pine was 33 per cent. stronger than heart pine. Mr. BROWN'S report was read before the Western Railway Club, and was an able defense of the common practice of using sap pine sills for cars. Another person signing himself; "Master Car Builder," wrote an article that appeared in the "Railway Master Mechanic," in which he states; "But close observers have found a serious objection to Georgia, or Southern pine, for car sills. Although it is very strong when green, as soon as it seasons it becomes so brittle as to be unfit for this purpose. Several years ago a series of tests were made with pieces of equal size of both Southern and Norway pine. The specimens broken and the number of pounds required to break each, were shown at the Master Car Builders' Convention and awakened deep interest in thoughtful minds. The Norway pine proved to be about 30 per cent. stronger than the Southern pine. *This great difference surprised many members, but some had already discovered it and would not permit Southern pine to be used in cars built for their companies. "For car sills the lighter sap-wood a ton saves in weight over heart-wood in the usual freight car. The writer of the above quoted article suggests that $40,000,000 could be saved per year in the cost of hauling this excessive weight, represented by the needless extra weight of the heart pine cars of this country.

Another advantage that sap pine trees have over the heart pine is in the fact that the former is much the larger tree. Schedules of timbers of much larger dimensions can be gotten in sap pine. On Contentnea Creek, North Carolina, there is a *Pinus mitis* tree that measures 22 ft. in circumference and would make a stick of timber at least 6 ft. sq. and 35 ft. long. Another pine in the same district measures 18 ft. in circumference and 100 ft. to the first branch. There was a pine felled there for making shingles which measured 4½ ft. in diameter and 142 ft. in length. These immense trees are found quite abundantly in that section and in other virgin short-leaved pine forests of tide-water North Carolina. Such trees would be exceedingly rare in the forests of long-leaved pine.

Considering its greater size and greater strength, and the greater ease with which this sap pine can be impregnated with creosote and thus made durable, is it not more valuable for construction purposes than heart pine? It would be of great

*Southern pine is long-leaved pine. Short-leaved pine is stronger than Norway pine.

value to our profession if the American Society of Civil Engineers would give this subject a long and thorough experimental study, and announce their judgment upon the question.

Some Appliances for Fire Protection.

The recent disastrous fires in Lynn, Boston, and Minneapolis have served to direct public attention to the urgent need of better systems of fireproof construction and more efficient means of extinguishing fires. The total destruction by fire in the United States during 1889 now seems likely to be at least $20,000,000 above the average. Since the recent sufferers by fire are Eastern cities, it cannot be claimed that this enormous increase is due entirely to the destruction of the flimsy wooden buildings of Western cities.

A recent special report of the Boston Manufacturers' Mutual Insurance Co. calls the attention of members of the company to several devices designed to lessen the fire risk, and commends them as worthy of at least a fair trial. We abstract parts of the report of most interest to engineers and those in charge of buildings as follows:

FIRE RETARDMENTS.

Under this head the Anti-Pyre Material, made by Samuel Cabot, of 70 Kilby St., Boston, and the paints and washes prepared by the Martin Process & Chemical Co., 43 John St., New York City, are referred to. The former is said to be an effective fire retardent for inside use. For the latter it is claimed that the substances made use of are antiseptic as well as incombustible. If the indications of laboratory tests are confirmed in actual use, these materials will be of great value. It is to be remembered that all ordinary varnishes are dangerous. Fire will spread very rapidly over a varnished surface. Ordinary paints or fillers cannot safely be used on heavy timbers for at least three years after they have been put in place without danger of dry rot.

The Anti-Pyre is a tenacious fireproof coating, made in all colors, for use on the interior woodwork of mills, distilleries, and other factories peculiarly exposed to fire. A double coat of considerable thickness can be applied at a cost of 2 cts. per sq. ft. In barrel lots the price is 30 cts. per gall., f. o. b.

The Martin Process & Chemical Co. offers fireproof oil paints, kalsomines, and fireproofing liquid for treating textile fabrics, such as tarpaulins, curtains, blankets, etc. Tests of these paints have been made by Prof. NORTON, of the Massachusetts Institution of Technology, Prof. R. OGDEN DOREMUS, of the College of the City of New York, Prof. HENRY A. MOTT, of the N. Y. Medical College, and others, with favorable results.

HOSE.

We have been called upon to make a second and more thorough investigation in regard to the quality and kind of hose which has been purchased for use in works insured by us. What purported to be linen hose, excellent in appearance, has been offered to members by dealers in fire appliances of previously good repute, which proved to be unsafe and unsuitable. It has been sold at less than the actual cost of flax, of a quality suitable to be manufactured into linen hose possessing sufficient strength for service. In more than one instance the buyer whom we have sent to purchase samples for our trials has been asked whether he wanted the hose "for use, or to hang up to satisfy the insurance inspectors." Trials of rubber-lined hose have also proved that while many varieties are strong enough, the difference in the weaving of the fabric, making the inner surface either rough or smooth, according to the kind of weaving adopted, makes an enormous difference in the friction and therefore the effectiveness of the stream.

HYDRANT PIPES AND NOZZLES.

Attention is also called to the great difference in the effective service of fire-streams according to the type of hose pipe which may be used. A very complete and instructive report of the tests of hose, hose pipe and nozzles, conducted under the charge of Mr. J. R. FREEMAN, engineer in the employment of the Factory Mutual Insurance Companies, has been printed; the rules and tables laid down therein will be of service to a thoroughly trained engineer or master mechanic. It has not been thought best to print this special report for general circulation, but copies will be sent to members who may ask for them. The investigation is to be continued with a view to laying down additional tables upon the sizes and quality of hydrant pipes and hydrants. When the investigation is completed and the final report is made, it will be circulated in the usual way, and a copy will be sent to every member.

VALVES.

Since the introduction of automatic sprinklers, it has become more important than ever to secure the adoption, at least in all new mills or works, of valves with simple attachments to indicate whether they are open or shut, it being essential that the valve to the automatic system, in all cases where there is no danger of freezing should be strapped open with a riveted leather strap and that the valve itself should show whether it is open or closed. Among the principal makers of valves meeting these requirements is the Chapman Valve Co.

ROOF HYDRANTS.

Many years since, the attention of members was called to the expediency of establishing a roof hydrant service at dangerous points, such as at the party walls parapeted out beyond the roof dividing large risks into different sections; also at points on roofs of works insured by us which are so near to other hazards as to create a danger from proximity. For this service attention was called to the Morse Monitor Nozzle. This apparatus has since been put in place at many dangerous points, and in more than one instance it has saved the insurance companies from loss which might have been caused by dangerous fires that have occurred near their risks.

The experience of city fire departments fully proves that a heavy stream poured upon the fire from a high point is very much more effective than a great number of streams throwing even a greater volume of water but in separate streams, from several points below. In the one case, the solid mass reaches the heart of the fire; in the other, the streams are dissipated in vapor before they reach the fire itself.

WIRE LATHING.

Wire lathing, so called, has in recent years been made in such a way as to be easily applied, not only to flat surfaces and to beams, but to wooden and iron posts, so as to protect them from ignition or from the heat of a fire. This mode of covering may be very desirable for the protection of iron posts in specially dangerous places. We may also call attention to the method of plastering directly upon the plank without the intervention of any separate lathing.

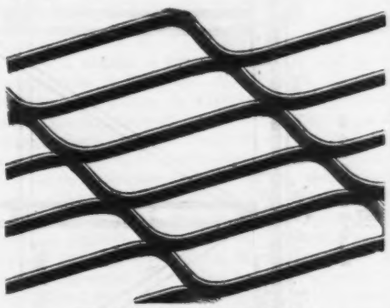


Fig. 1. A New Metallic Lathing.

Among the recent types of wire lathing is a style known as the Stanley corrugated, made by the Clinton Wire Cloth Co., of Clinton, Mass. It is claimed to be unaffected by heat or cold, and may be used on columns, girders, etc., without furring of any kind, giving a perfect key for plastering, with no interspace for currents of air.

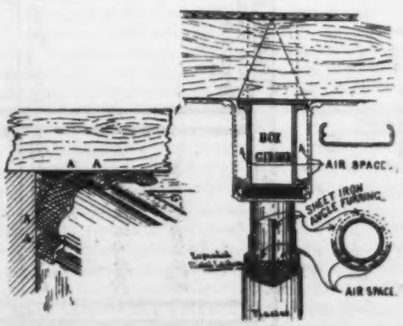


Fig. 2. Fig. 3.

A very novel type of metallic lathing has recently been put on the market by the Central Expanded Metal Co., of Pittsburg, and a section the full size of mesh is shown in Fig. 1. It is made from a sheet of soft, ductile steel, slashed and opened out to the form shown in the engraving. Its construction makes it self-furring on flat or curved surfaces, where it readily takes and retains the form desired. Expansion and contraction are localized at fastenings.

If an air space is required in fire-proofing either wood or iron columns, with the use of angle furring strips and the lathing, as complete protection can be obtained as by the use of tile, with about one-tenth of the weight and one-quarter the cost.

Fig. 2 shows the use of the lath for forming cornices, and Fig. 3 shows the lath covering ceiling, box girder, and column.

Another excellent idea in lathing is the combined sheating and lath made by the Byrkit-Hall Sheathing Lath Co., of Chicago, which consists of a ⅜-in. board on whose face are cut dovetail grooves to hold the plaster. It has been largely used in the Northwest and is claimed to be especially useful in slow-burning construction.

Among other seemingly meritorious devices are the Tillotson automatic fire door, so arranged as to be opened and shut like a common door and yet shut automatically in case of fire, and the Coburn trolly tracks for automatic fire doors. The former device is controlled by the Providence Steam & Gas Pipe Co., and the latter by the Coburn Trolley Track Mfg. Co., of Worcester, Mass. Attention is also called to the Worcester chemical fire pail, an apparatus on the principle of hand grenades but furnishing a larger quantity of the chemical liquid, for extinguishing a fire after it has gained considerable headway.

Storage Batteries and Street Car Motors.

The "River and Rail Electric Light Co.," of 45 Broadway, New York, has issued a circular making some interesting statements, from which we abstract the following. The inventions controlled by the company are chiefly those of Prof. WM. MAIN:

MOTORS.

The electric motors now in use in this country and in Europe are modifications to a more or less extent of the original Siemen's dynamo-motor. In all of them are large masses of revolving coils of wire, which are constantly liable to injury and disintegration. In Prof. MAIN'S motor no wires revolve. The shaft and cross arms revolve, but all else is stationary. An apt comparison is found in the use made of water power. The dynamo motors with revolving wires resemble the overshot water-wheel, while the Main motor resembles the more compact and powerful turbine. This is fully shown in the weight of the material in the Main motor per mechanical horse-power. The average weight of the motor is from 40 to 50 lbs. per H. P., while other motors now in use range from 100 to 300 lbs. per H. P., a safe average being 150 lbs. per H. P. It will easily be seen that the cost of the Main motor will always be less than that of any other, to say nothing of the advantages in lightness and compactness.

STORAGE BATTERIES.

The storage batteries which have been used commercially in this country or in Europe have been made by the same process, that of "active material" so-called, pasted or pressed upon lead plates of various devices.

The United States Courts have lately been endeavoring to determine the ownership of this process, and the end is not yet. Prof. MAIN'S battery does not resemble that of any of the contestants for the prior claim to the right to use "active material" in any form. The following description of the Main battery, by Prof. GEO. H. BARKER, of Philadelphia, at the meeting of the American Association for the Advancement of Science, is a clear and concise statement of its construction and cannot be improved upon:

"A zinc peroxide-of-lead battery has recently been brought out after tests extending over two years time. The negative plate is composed of well amalgamated zinc and copper riveted together. No electro-motive force is set up between two such amalgamated plates. The positive plate is built up of a large number of thin lead plates covered with graphite and riveted together with lead rivets about an inch apart. The compound plate is then perforated with numerous small holes. The graphite keeps the plate apart and allows the solution to penetrate into every portion, so as to reach the entire lead surface. The electrolyte is an acid solution of zinc sulphate. No active matter in the form of lead oxides is applied to either plate; but the positive is strictly a Planté plate of very large surface. During the charging process the positive is peroxidized, and metallic zinc of a beautiful crystalized appearance is deposited upon the negative.

These cells show an enormous increase in storage capacity per pound of metal as compared with cells of the Faure type. A table of comparisons with several other cells was given, which exhibited the superior storage capacity of this new battery. The new cell permits any rate of charging and discharging, and is exempt from the usual danger of sulphating. In fact, in this respect it resembles the original Planté, which is much less liable to suffer from rapid discharge or from exhaustion than the Faure form.

Durability in a storage battery is a matter of the greatest importance. The energy and receptivity of a battery can well be diminished if durability is secured. No storage battery now in the market has stood the test of time. Prof. MAIN has been fortunate, however, in

inventing a battery which not only has greater energy and storing capacity than any other, but surpasses all others in the vital point of durability.

The report of Profs. CHANDLER and LAUDY on the Main Storage Battery is subjoined. The letters *A B* and C in the comparative statement are inserted in place of the real names of the companies whose batteries were tested, for obvious reasons. The batteries alluded to are prominently in use, and are considered the best of the "active material" type.

SCHOOL OF MINES, COLUMBIA COLLEGE, Sept. 2, 1889.

MY DEAR SIR: After using the River and Rail Storage Battery for several months in comparison with several of the best known and most largely used batteries of other inventors, we are able to say that the River and Rail battery proves to be far superior to any other storage battery that has come under our observation.

First.—As regards electro-motive force, it surpasses all the other batteries we have tested.

Second.—As regards durability, it is superior to all others. We have purposely subjected it to very rough treatment, both in charging and discharging, such treatment as would have ruined other cells, and have not been able to detect any evidence of deterioration in consequence, on either of the plates, nor any tendency to short circuiting. In fact, the cells are at this moment in just as good a condition as they have been at any time since they came to us, over five months ago.

Third.—As regards capacity, this battery is decidedly superior to all others we have tested.

Fourth.—The peculiar construction of this battery makes it possible to employ a very high rate of discharge without injury, which is a very important item for some purposes.

Fifth.—The charge is well retained on standing.

Sixth.—No bad effect results from partial discharge.

Seventh.— This battery is not easily injured by rough handling either rapid charging or short circuiting.

Eighth.— For weight of metal in the cells the capacity for work is two or three times greater than in any of the other batteries tested.

In conclusion we would say that in every respect this battery is superior to the other. We have not been able to discover any point of weakness in any direction, in its construction or working.

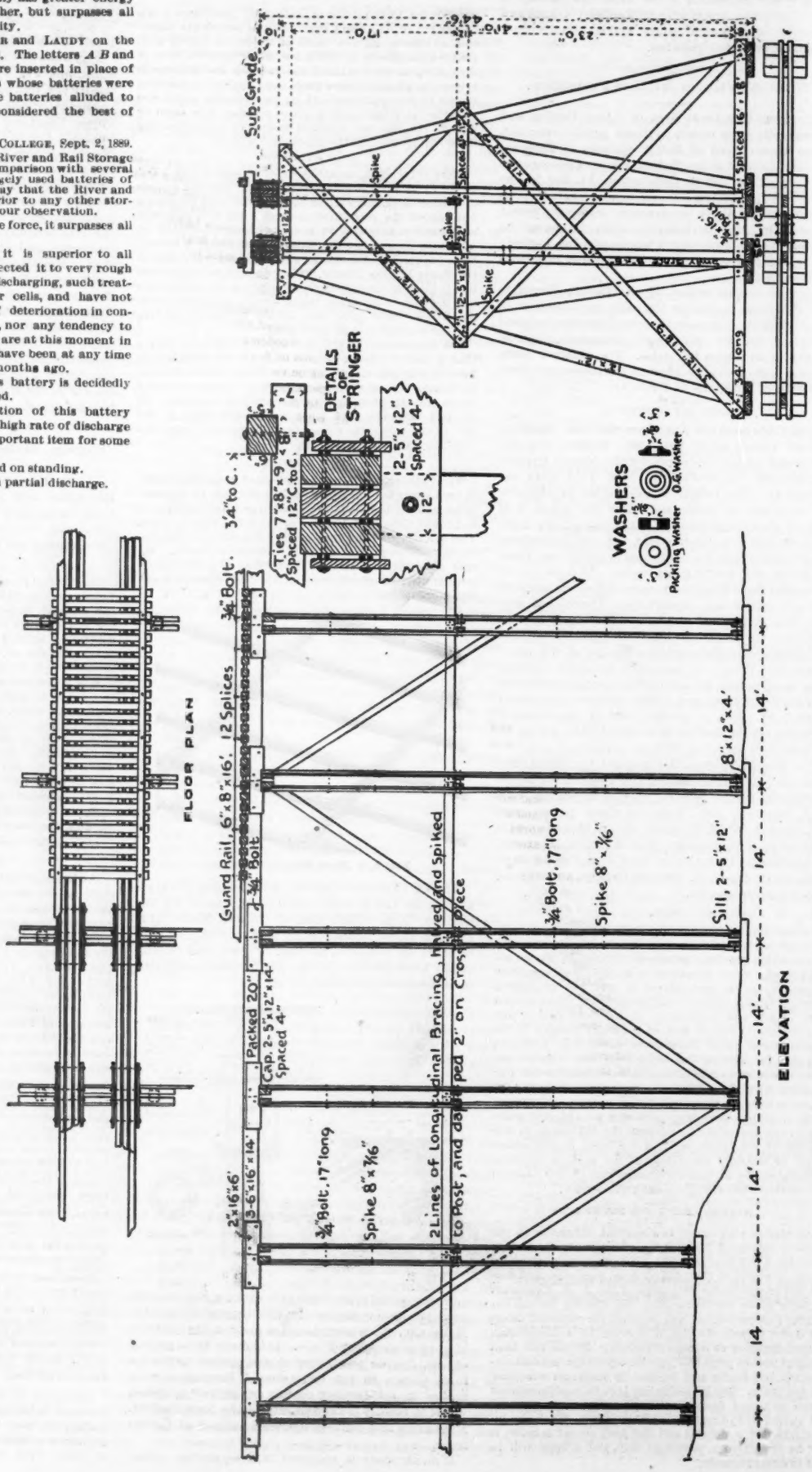
In making the comparative tests all batteries were employed under exactly the same conditions so that the tests are perfectly parallel and fair.

THE SYSTEM OF STREET PROPULSION.

The practical difficulty, which all who have been concerned in electric street railways in the past two years are well aware of, is in transmitting the power to the axles of the car efficiently and economically. The starting of a car from a dead rest without a sudden and great increase of power has been the problem to be solved. Various expedients have been tried, but never with complete success. Some companies have constantly increased the size and weight of their motors, so that we now often see a 15 H. P. motor on each axle of a car or 30 H. P. in all, weighing perhaps a ton or more, to do the work hitherto effected by two horses. This fact alone shows their error.

Several years ago Prof. MAIN, aware of the difficulty which confronted him, thought out a device by which the power of the motor is transmitted to the axles of a car without any sudden increase of current from the battery. The motor never stops running while the car is in use, but is thrown in and out of gear at the will of the driver.

Prof. MAIN's device for gearing down and starting has been fully tested on the company's private experimental car, which is now at Fort Hamilton. While light of itself, it enables a motor weighing but 800 lbs. geared to both axles of a car to surmount heavy grades and to pass sharp curves at a speed of from 4 to 13 miles an hour, as required, with no increased call upon the batteries.



Timber Trestles, "Cluster Bent" Type. Wheeling & Lake Erie R. R. C. A. WILSON, *Chief Engineer*. (See Page 544.)

Name of Battery	Rate of discharge in amp'res	Electro motive force at beginning of discharge.	Voltage during discharge.	Ampere hours down to 11 volts.	Total Watt hours down to 11 volts.	Weight of metal in cells.	Ampere hours per pound of metal.	Watt hours per pound of metal.
			6 Cells.		6 Cells.	Pounds.		
River and Rail Electric Light Company.	21.75	2·6	15¼ to 11	234	3,296	27	8.62	20.30
	34.00	2·6	15¼ to 11	201	2,769	27	7.42	17.08
	40.00	2.6	14¾ to 11	171	2.326	27	6.31	14·30
			6 Cells.		6 Cells.			
A. Battery	29.50	2'5	11½ to 11	94	1,053	26	3 61	6·75
	40.00	2·0	11¾	90	1,006	26	3·46	6·45
			6 Cells.		6 Cells.			
B. Battery	28.50	2·0	11½ to 11	132	1,513	30	4.40	8·40
	38·00	2·0	11½ to 11	123	1,314	30	4·10	7·30
			6 Cells.					
C. Battery	26·00	2.0	11¾ to 11	131	1,495	57	2·39	4·37
	41·00	2.0	11¾ to 11	101	1,131	57	1·77	3·31

That this difficulty of starting a car without great and sudden increase of power has been a problem for other thinkers, is shown by the following quotations (omitted) from different parties, who while seeing the difficulties involved, were at a loss to show how they might be avoided.

The general feeling among those who have had most experience with the overhead wires is voiced in a private letter dated Sept. 4, 1889, by a prominent street railroad man in Ohio, who is running both horse cars and overhead wire cars, and from which we are allowed to take the following extract:

I do not care how many overhead systems are put up, the moment you come into the market with a practical, economical, durable storage system, the overhead wires must go. All the street railroad men that I hear of are building with knowledge that this is so and in talking tell how much it will cost to change.

The Electrical Review, London, Eng., Nov. 16, 1888 says:

Any one who has read the discussion on the overhead system can safely come to the conclusion that, although other systems are worked in America, the practical outcome of all these gigantic works is that the storage battery is the only safe and practical means for street transit.

The ideal of the street railroad man is to have each car on his line a unit, independent of every other. This is plainly shown in the address of the President of the Street Railway Association at its meeting held in Minneapolis, Oct. 17:

The overhead system has thus far been demonstrated to be the most practical, but it is the hope and wish of every street railway manager that the system will be superseded and that the motor of the future will be a motor independent of a central plant or a wire circuit.

At the same meeting the Special Committee on Electricity make the comparison between the cable, the overhead, and the storage battery system to the advantage of the latter.

Cost of Construction of a Ten Mile Road with 15 Cars.

Cost of cable construction	$700,000
" " power plant	125,000
" " 15 cars	15,000
	$840,000

Electrical Overhead Wire Construction.

Cost of road bed	$ 70,000
" " wiring	30,000
" " cars (15)	60,000
" " power plant	30,000
	$190,000

Storage Battery.

Cost of road bed	$ 70,000
" " 15 cars	75,000
" " power plant	30,000
	$175,000

While the first cost is less, as thus frankly stated by the Committee, that the cost of operating a storage battery road is less than that of operating an overhead wire road is plainly to be seen. In charging storage batteries from a dynamo, the loss or waste is reduced to a minimum, the current goes in, the battery is charged and there is an end of it. But a current of great intensity sent over an overhead wire, even with the best insulation attainable, and which goes into a motor which is now stopping and now running, must from the nature of things be wasted. Any one who has seen the sparks of fire issuing from the wires, the trolley, and the motor of an overhead wire car, will readily perceive the great waste.

The whole question is one of the economical application of power. Every practical engineer knows that power is wasted when an engine is either over-taxed or run much below its normal capacity. When cars are driven by the overhead system directly from the dynamo, the strain is excessive during "rush" hours, while at others, particularly at night, the engine would be kept in motion although doing little useful work. The storage battery is simply a reservoir of power which reduces the work of the engine to uniformity, although cars may be run nearly empty and at long intervals, while during the early morning hours, after the work of the day has commenced, they would follow each other in rapid succession while loaded down.

The Manitou & Pike's Peak Railway.

The Manitou & Pike's Peak Ry., in Colorado, which is to be built up the mountain of Pike's Peak, and the grading of which was commenced two months ago, will be built on the Abt rack-rail system, and will be the first application of this system in America. The first surveys for the road were made in November and December of 1888 by Mr. F. E. BAXTER, C. E., of Colorado Springs, Col., who located the line which will be very closely followed in the present construction. Mr. R. E. BRIGGS, of Denver, then Chief Engineer of the Denver & Rio Grande R. R., was afterwards appointed Chief Engineer, with Mr. T. F. RICHARDSON in charge of the final surveys and of the construction of the road. Major JOHN HULBERT, of Manitou Springs, is President of the company; among the directors are Mr. CABLE, President of the Chicago, Rock Island & Pacific R. R., Mr. Z. G. SIMMONS, of Kenosha, Wis., and others. Mr. SIMMONS has also taken the entire contract for the construction and equipment of the road. Mr. W. HILDENBRAND, C. E., of New York, who is the representative of the Abt system, is Consulting Engineer; he will furnish the rack-rail and be in charge of the laying of the same. The order for the rack-rail has been placed with the Johnson Co., of Johnstown, Pa.; the Baldwin Locomotive Works, of Philadelphia, Pa., have an order for three locomotives, and the Wason Mfg. Co., of Springfield, Mass., has the order for six passenger cars. Lantry & Sons, of Denver, are the contractors for the grading and road-bed, and they had four miles graded when the recent heavy snowfall prevented further work on the upper part of the mountain. It is intended to open the road for traffic on July 1, 1890.

The length of the road is 8¾ miles, but the track, including switches and side tracks, will be 9.4 miles long; the total rise is 7,600 ft., giving an average grade of 16.3 per cent. The maximum grade is 25 per cent. and the minimum grade 7.6 per cent. The lower station is 6,600 ft. and the summit 14,200 ft. above sea level.

The locomotives will weigh about 25 tons in working order, and the specifications require that each engine shall have sufficient power to push two loaded passenger cars, weighing from 20 to 21 tons, up the 25 per cent. grade at a speed of three miles per hour, up the average grade at five miles, and up the minimum grade at eight miles per hour. Each locomotive will be provided with three driving pinions or spur wheels working in the rack rail, and will have ample brake power to stop and hold the train on the down trip. In addition to this each car will have separate brakes, enabling it to be stopped independently of the locomotive. No expense will be spared to make the equipment first-class in every respect. The cars are to be arranged for 50 seats, will be handsomely finished and comfortable to ride in. They will be carried on four wheels, which will be loose on the axles; the object of this is to make the cars as light as possible, which is an important item in the construction as well as in the operating expenses of a rack railway.

The rack-rail will consist of two bars, 4½ ins. deep and varying in thickness from ⅝ in. to 1¼ in. according to the grade. It will be of mild steel of the highest quality as to strength and ductility. The chairs carrying the bars will be of annealed cast steel. The splice bars and bolts will be of best quality iron. To prevent creeping down hill, the track will be anchored to about 200 stone or rock anchorages.

The work is to be pushed with vigor, so as to have the road opened at the appointed time, and to obtain the revenues of the next season. It is estimated that the road will carry an average of 300 passengers per day, which will give very good returns on the outlay of the capital for the construction of the road.

Solid Bridge Floor, Oriskany Bridge, New York Central & Hudson River Railroad.

(With Inset.)

In continuation of our illustrations, of Nov. 16 and 23, of the solid bridge floor practice of the New York Central & Hudson River R. R. Co., we show this week the Oriskany Bridge on the same road. This span has a total length of 65 ft. 9 ins., from out to out of end angles, with the height and other detailed dimensions given in the plan.

There are three trusses in each span, of which the center, or heavier one, is only shown. The two outside trusses have the same general dimensions, but differ somewhat in sections of members and slightly in the omission of the channel irons 19 ins. long, shown immediately under the center truss.

The dimensions and general arrangement of this structure are sufficiently well illustrated on the elevation and plan given; and for the good and bad points of this type of bridge-floor, we would refer our readers to the extract given in our issue of Nov. 23, from the forthcoming paper of Mr. GEORGE H. THOMSON, Bridge Engineer of the New York, Central & Hudson River R. R.

Tar Concrete Sidewalks.

The following are the regulations for the construction of concrete sidewalks at Providence, R. I. The sidewalks for their whole length shall be the width as occupied, ⅝-in. rise per foot from the inside of the curb to the street line, except modifications necessary to meet the occupation line, and shall be otherwise constructed in manner and of materials as follows, viz:

All material above said grade shall be excavated and removed. Good sand or gravel shall be used for filling whenever it may be required. The foundation shall be composed of clean coarse gravel, properly coated with tar, and shall not be less than 2 ins. in depth, after being rolled and thoroughly compacted. The top of the foundation shall be brought to a smooth surface by the addition of fine pebbles completely coated with tar and thoroughly rolled. The top dressing shall consist of clean, sharp sand, thoroughly saturated with tar, and applied in a layer of such thickness that, after being rolled and compacted, it will not be less than 1 in. depth. The total depth of walk when finished shall not be less than 3 ins. The quality of the tar used shall be equal in all respects to that made by the Providence Gas Co. The gravel and sand shall be thoroughly dry before coating or saturating the same with tar.

THE FOREST PRESERVATION question is again to be brought before Congress. Secretary NOBLE has been urged by a committee of the American Association for the Advancement of Science to ask Congress in his annual report to legislate for the protection of the forests with a view of preserving the water supply. The Secretary is said to be favorable to the proposition, and will probably make such a recommendation. Secretary RUSK has already come out in favor of such legislation, but this is not a new thing in Congress. Senator SHERMAN and others have introduced bills on the subject. It will probably require a good deal of education to get Congress to pass any bill on this important matter.

THE WATER IN THE VYRNWY RESERVOIR is now within 6 ins. of overflow level and therefore amounts to 13,000,000,000 galls.

PERSONAL.

Capt. WM. H. BIXBY, U. S. Engineers, has been ordered to temporary duty at Fort Macon, N. C.

Mr. ALBERT S. GLOVER, Water Registrar of Newton, Mass., has resigned.

Mr. W. J. JOHNSTON, the publisher of the *Electrical World*, was married in this city on Dec. 3 to Miss GRACE W. JOHNSTON.

Mr. S. ASHTON HAND has been made the General Superintendent of the long-established Pascal Iron Works, of Morris, Tasker & Co., of Philadelphia.

Mr. J. A. GALBRAITH will, it is said, become General Manager of the Mexican National road on Jan. 1, vice Mr. O'BRIEN, resigned.

Mr. C. W. COOLEY has been appointed Superintendent of the locomotive shops of the Puget Sound & Shore road at Seattle, Wash.

Mr. T. NEHER, C. E., of St. Louis, Mo., has been appointed Chief Engineer of the Middlesborough Belt Railroad and Engineer in Charge of Construction by the Middlesborough Steel Ore & Coal Co.

Mr. A. J. LESCHORN, C. E., with the Phœnix Bridge Co., has been awarded a silver medal by the managers of the Cologne International Exhibition for his trigonometer, described in this journal on Nov. 24, 1888.

Mr. PAUL H. EVANS has been appointed Roadmaster of the Fulton County Electric St. Ry., at Atlanta, Ga., which is being built by the Thomson-Houston Electric Co., of Boston.

Mr. JOHN C. BRECKINRIDGE, for a long while with the surveying corps of the Chesapeake, Ohio & Southwestern Railroad, has been appointed to a position in the general offices in Louisville, Ky.

A FIRM carrying on the business of civil, mechanical, and mining engineers has been organized at Columbus, O., by JOHN H. MCCORMICK, GEORGE P. GOOD, and COLEMAN A. TERRY. Their office is in the Hinman and Beatly block.

Mr. JOS. C. PLATT has withdrawn from the Mohawk & Hudson Mfg. Co. (Eddy Valve Co.) of Waterford, N. Y., of which he has been President since its incorporation in 1875. Mr. PLATT does not sell any of his interest in the business though withdrawing from participation in its management.

Mr. C. E. HENDERSON, late General Manager of the Ohio, Indiana & Western road, has resigned to accept a position with the Philadelphia & Reading. His headquarters are to be at Pottsville, Pa. His position is to be that of General Manager of the coal and iron interests of the company at that point.

Mr. WATSON B. DICKERMAN, of New York, has been appointed Receiver of the Norfolk Southern Railroad by the United States Circuit Court for the Eastern District of Virginia, Mr. H. KING, who has been General Manager of the road since its construction, will continue in that position under the receivership of Mr. DICKERMAN.

Mr. W. H. MCCLINTOCK has resigned the position of Superintendent of the Savannah & Western, and Mr. W. J. HAYLOW has been appointed in his stead. Superintendent MCCLINTOCK came to the Central with Major BELKNAP. He was formerly of the Western Railway of Alabama, with General Manager GABBETT.

SAMUEL WILKESON, Secretary of the Northern Pacific Railroad Company, died in this city on Dec. 2, at the age of 72. Most of his early life was spent in journalism. At the time of the starting of the Northern Pacific enterprise, Mr. WILKESON was one of its leading advocates. He took part in the first explorations for the road and by his writings assisted JAY COOKE in floating the bonds for its construction.

Mr. J. P. BRENTON, President of the Richmond, Fredericksburg & Potomac Railroad, has resigned, Major E. T. D. MYERS has been appointed to succeed him. At a meeting of the Board of Directors of the Tennessee Coal & Iron Co., General RUSSELL A. ALGER, of Michigan, was elected a director in place of ex-Governor JOHN C. BROWN, of Tennessee, who died recently. Ex-Senator THOMAS C. PLATT has been elected President of the company in place of Mr. BROWN.

THE following appointments have been made on the Louisville, New Orleans & Texas Railway: Capt. A. A. SHARP, heretofore Superintendent of Transportation, will be Superintendent of the New Orleans Division with headquarters at Vicksburg, Miss. Mr. W. F. MEATH, Superintendent of the Memphis Division, with headquarters at Leland, Miss. Mr. A. W. ROBINSON, Superintendent of the Riverside Division, with headquarters at Greenville, Miss. Mr. T. J. NICHOLL is General Superintendent, and Mr. JAS. M. EDWARDS is Vice-President and General Manager.

Mr. WILLIAM BIRNIE, of the contracting firm of Goodhue & Birnie, died at Springfield, Mass., Dec. 2. He was born at Porto Bello, Scotland, in November, 1818, and came to America in 1827. His introduction to Springfield was through his brother ALEXANDER, who had contracts for masonry on the Boston & Albany Railroad. When his brother moved to Hastings, N. Y., in 1842, Mr. BIRNIE was associated with AMASA STONE and DANIEL L. HARRIS, who were interested in the Howe truss-bridge patent. The three would take contracts for railway bridges jointly, and then Mr. BIRNIE built the masonry for them. These contracts were not confined to a single section, for they built the Belle Isle bridge over the James River, at Richmond, Va., and all the bridges on the Richmond & Danville Railroad, did work on the Stonington & Harlem Railroad, constructed the Water Shops race-way, the foundation for the Armory fence, and took the entire job of building the Springfield & New London Railroad, extending 8 miles to the Connecticut border.

A very important work in which Mr. BIRNIE was engaged with DANIEL L. and JOEL B. HARRIS, the latter now of Rutland, Vt., was the building of the stone bridges on the Harlem Railroad from the Harlem Bridge through the Harlem flats. They were also awarded in competition with many other firms a contract for the masonry and bridge at Havre de Grace, Md., but the Philadelphia, Wilmington & Baltimore Railroad Co. became alarmed at the magnitude of the undertaking and paid the contractors $5,000 in addition to all expense which they had been at, to stop work. Besides these contracts, which his good judgment brought to a successful result in almost every case, Mr. BIRNIE became interested in other lines of business. In 1875 he entered into partnership with CHARLES L. GOODHUE. The firm started in the construction of water-works, and have been remarkably successful; they have built water-works entire in 60 cities and towns, and partially built 20 more.

Mr. GEORGE H. PENDLETON, late United States Minister to Berlin, died at Brussels, Belgium, Nov. 24. In 1869 Mr. PENDLETON was made President of the Kentucky Central Railroad, at a salary of $6,000, principally for the purpose of protecting the interests of his sister's family. This road was about 100 miles long, connecting Covington with Lexington, Ky., with a branch to Paris. R. B. BOWLER, of Cincinnati, the husband of Mr. PENDLETON'S sister, owned three-fifths of its stock. When he died, near the close of the war, Mr. PENDLETON was called upon to settle up his estate, which was left in a far from satisfactory condition. He had considerable property besides his railroad interests, but there were many claims upon it. After several years of careful management Mr. PENDLETON turned over property valued at over a million dollars to the heirs, who at one time doubted whether they would get anything after the payment of debts. Among the claims held by the Bowler estate was one of $85,000 against the Government for the transportation of troops and supplies over the Kentucky Central Railroad during the war. This claim was for extra allowances beyond the fixed rates, and covered the period between May, 1862, and August, 1864. In 1864, when all the facts were fresh and the witnesses within easy reach, A. H. RANSOM, an ex-employé of the road, who was offered a contingent fee of 25 per cent., went to Washington to prosecute the claim. General HOLT, General MEIGS, and Secretary STANTON rejected the claim twice, and the case was then abandoned. Seven years later Mr. PENDLETON, then President of the Kentucky Central, appeared as prosecutor of the claim, and, against the settled usage of the public service, the case was reopened. The claim, with interest, was paid by Secretary BELKNAP, the total amounting to $148,553.82.

BOOK REVIEWS.

Road Legislation for the American State. By JEREMIAH W. JENKS, Ph. D. Publications of the American Economic Association, RICHARD S. ELY, Secretary. Johns Hopkins University, Baltimore, Md. 1889, 8vo, pp. 82, with tables. Price 75 cts. Also for sale by ENGINEERING NEWS PUBLISHING CO.

The subject-matter of this timely work of Prof. JENKS is divided under the following heads: (1) Economical and Social Significance of Roads. (2) Road Legislation in the United States. (3) Taxation for Road Purposes. (4) Administration of Roads. (5) System in other Countries and Suggestions of Engineers. (6) Suggestions for Road Legislation. Appendices give the road laws of France and a tabular digest of the leading provisions of road laws of the States and Territories.

The first chapter is devoted to showing what bad roads cost in the transportation of goods by wagons and horses, and it calls the attention of the farmer to the fact that the present average actual cost of hauling 100 bushels of grain one mile is sixty cents. With an annual wheat crop alone of nearly 500,000,000 bushels, which all has to be transported by road several miles on the average, the full meaning of any unnecessary outlay due to bad roads is made plain. Any decrease in this item of expense resulting from improved roads is largely the farmer's gain.

In a paper read at the Springfield, Ill., meeting of Highway Comissioners in 1888, it was estimated that in Illinois a "good load" of farm produce could be hauled over existing roads for about three months in the year; for another three months it was possible to haul two-thirds as much; and for half the year not more than half of the first named load could be hauled. If this is a fair average of road efficiency, as Prof. JENKS believes it is, even good dirt roads would reduce the cost of transportation on country roads by one-half; and a good, permanent road would make the cost of hauling less than one-quarter of what it now is. Not the least among the advantages of a road always good is the fact that the farmer might then select his own convenient time for transporting his produce to market, and not be compelled to do this at a season when every one else is doing the same thing and when the market is perhaps overstocked by this common unloading upon it.

According to the Illinois estimate of road condition and the average amount hauled at various seasons of the year, an ordinary draught horse, whose earnings on good roads may safely be estimated at 50 cts. per day, or $150 per year of 300 days, on these poor roads would only earn two-thirds as much, $100 per year. At this rate the estimate of Prof. ELY, in "Problems of To-Day," that poor roads, on the average, cost the farmer $15 per horse per year is a low average. But even at this low rate, the loss to the State of Illinois alone is more than $15,000,000 annually, taking the farm census of horses as a basis. Mr. CLEMENS HERSCHEL, in his treatise on roads, states that an English horse working in a city or on a country road does twice as much work as the American horse similarly employed in America. "The simple explanation is that the Englishman has invested in permanent roads what the American expends in perishable horses that require to be fed."

The author also points out the fact that better roads would mean cheaper communication with the markets and a consequent enhanced value in farming lands. Engineering experts have stated that a thorough drainage of the prairie roads would add $15 per acre to the value of the best farms in Central Illinois. But if only $5 were added to the estimated average value of $32 per acre in Illinois, the increase in the 32,000,000 acres of farming land in that State would mean $160,000,000 added to the aggregate wealth of the State.

In the second chapter Prof. JENKS discusses briefly the reasons for our present imperfect system of road legislation. Sparse population, lack of capital and almost purely local traffic favored the introduction of what was at the time the English form of road maintenance. About 1806 the National Government commenced to foster through traffic by special grants and appropriations for public highways; but the introduction of railways in 1830 lessened the need for the longer wagon roads, and as an incidental the importance of good local roads was also lost sight of when roads dropped from national politics. Ancient laws controlling maintenance, the conservative spirit of the people, and the desire to retain local control coupled with the almost universal lack of skilled engineering in their location, account for the present bad roads. In all but five States the labor tax system is regularly employed; in four more the labor tax is laid in the case of a special levy; and in Illinois a vote of the town decides whether the tax shall be in labor or money, and the majority of them vote for the former. Six Southern States make no provision for a money tax at all, and rely wholly on labor, though this law is doubtless a relic of the past conditions of labor.

The vital question of taxation for road purposes is discussed in the third chapter. In this section the author starts with the assumption that the burden should be distributed in accordance with the benefits received, though he admits that this distribution is often a difficult one to make. The old toll-road theory that the traveler is the one benefited is controverted by the discussion in the first chapter, where it is shown that good roads affect the interest of abutting owners and terminal points quite as much as that of the traveling public alone. After briefly describing the practice in various States, Prof. JENKS concludes that the most satisfactory system would be one which separates local from main roads and supports each class by taxation of the various administrative sub-divisions of State, county, and town. Concerning the character of this tax, the question is whether it shall be property or poll tax, money or labor. A poll tax may be defended by the statement that in this manner a tax may be collected from many who would not and could not pay a money tax. But the trouble is that under our present system of working roads, this labor tax probably does more harm than good; it is human effort wasted. The remedy for this defect lies in efficient supervision of road construction and repair, under a paid official who is held responsible for the condition of the highways. And the experience in France—and elsewhere where it has been tried—is that regularly paid laborers do more and better work than the casual helper who is simply working out a "tax." The French system of using

the farmer's teams, instead of hiring horses and carts, works well. In Nevada a labor tax is permitted after a high money tax has been levied and expended; and in this shape it is perhaps advisable. But on the whole the author, with many other writers on this subject, condemns the labor tax system as wasteful and usually inefficient.

Toll-roads may be justified in a new country where for long stretches there are few or no inhabitants; for in such cases it is often a question of a toll road or practically no road at all, and to most voters the toll-road seems better than a bonded debt. But Prof. JENKS believes that in addition to fixing the rate of toll, the representatives of the people shall also make a law providing for the surrender of the company's franchise. The Nevada law is recommended in this connection as by it, after ten years use, the road becomes public property, and five years after completion the county may at any time purchase at an appraised valuation. Private control of roads, however, generally results in a minimum of expenditure for maintenance; and, where the companies are strong enough, an effort to control legislation and prevent enactments that would interfere with their "rights" and profits.

The administration of roads is treated of in the fourth chapter. Assuming that these roads should be classified according to their importance, Prof. JENKS believes that the county board of supervisors, or the equivalent body, should decide upon the amount to be raised for the more important roads; while the town officers should exercise the same rights for the local roads. Of course, if a main road should in part of its route perform the functions of a local road, the town should pay into the county fund its fair share for this purpose. As a rule, the towns would probably prefer that the county board also maintain the local roads on payment of the proper amount into the county fund; and as each would be represented on this board no real injustice need be feared.

But when the amount of money to be expended is fixed upon, it is all-important that the board should have a proper knowledge of what is needed and what it will cost, and this money should be expended under the direction of a capable official responsible for results attained. These conditions can only be met by the appointment or election of a civil engineer. Prof. JENKS favors appointment rather than election, for the good reason that an engineer of the experience and training required often cannot be found within the county. The skilled services of the engineer are indispensable to such a board and the county it represents, for before any money can be judiciously expended a good topographical map should be made, covering the county in question, and showing existing roads and their grades, the character of the soil, etc. The road commissioners of Illinois, at the meeting before referred to, frankly admitted that under the present system at least half the money expended on roads in that State was wasted through ignorance. On this basis "the waste" would represent annually about $2,500,000 in that State, a waste that would be largely prevented by the employment of skilled engineers. The problem to be solved by the road-maker in many parts of our country is not so much the making of good roads as that of making the best roads possible with the material and means available. This is work that requires the best engineering training and experience, and it is experience of a character that cannot be found on the spot as a rule.

Permanent roads are not built in a season over a county, and the office of the engineer should be practically permanent through good behavior and general efficiency. He could then look ahead in his plans, and see that what permanent work was done formed part of a system that time would complete.

County organization, as before outlined, would seem to be very necessary in securing and using suitable machinery for road making. A good steam roller, for example, costs about $5,000 and one town could hardly afford to buy it. But such a machine is essential to good and economical work; a good and dirt road can hardly be made without it. Mr. HERSCHEL says in his exhaustive article on road-making, "it will do the same work at one-quarter the running cost and in one-half the time of a first-class horse road roller." Mr. T. J. NICHOLL, in a paper read before the Civil Engineers' Club of the Northwest in 1878, estimates the cost of one mile of prairie road, made with the aid of a road-roller, at $285. He adds that this 15-ton roller would cost about $5,000; the labor, fuel and operating expenses amounted to $5.00 per day, and moving at an average speed of 2 miles per hour, rolling 6 ft. wide, in one day it would compact 2 miles in length by 19 ft. wide. In dry weather, when the roads are good, the rollers can be replaced by driving wheels and the machine made to pay for itself in hauling gravel, cinders, broken stone, etc.

The location of a road system, especially in the newer States, is a matter of prime importance and one requiring for its best solution a most careful study and comparison of conditions and requirements, and consequently the services of the best engineers. The systems in use in Germany, England, etc., to attain this end are briefly outlined. The French road system is also detailed at some length by Prof. JENKS, but for these data we would refer our readers to articles on this subject commenced in ENGINEERING NEWS of Feb. 16, 1889, and to "The Science of Road Making," an able treatise by Mr. CLEMENS HERSCHEL, C. E., also published in this journal in 1877.

Chapter VI. relates to suggestions for road legislation and outlines a scheme for classification and control and maintenance of roads. Appendices follow giving in a tabulated form a digest of the leading provisions of the road laws of the various States and Territories. This digest is a laborious but seemingly carefully prepared exhibit of the very much mixed methods now in force in the United States, and points out better than anything else could the urgent need of the introduction of a more modern and efficient system.

PUBLICATIONS RECEIVED.

—*Hints on House Building.* Some desultory notes in popular form, mostly reprinted from *The Mechanical News.* By ROBERT GRIMSHAW. Second and enlarged edition. Practical Publishing Co., New York. 12mo. 77 pp. Price 50 cts.

A very readable little book, filled with useful hints on the arrangement, purpose, and decoration of the various rooms of a "home." It is purely non-technical and deals largely with the sanitary requirements of a house.

—*Architectural Sketches.* With Suggestions Applicable to Modern Structures. By BRADFORD L. GILBERT, Architect, New York. Pamphlet.

A very tastefully prepared collection of designs, largely for railway stations and public buildings, of which Mr. BRADFORD makes a specialty. He is the architect of the "Tower Building," 50 Broadway, New York, which has been much and justly admired as a most skilful solution of an exceedingly difficult problem, putting a 15 story building on a 21-ft. lot. No neater yet simpler piece of architectural design is to be found in New York.

—*Transactions of the American Institute of Electrical Engineers*, Vol. V. 1887-1888. August and September, 1889. 8vo. pp. 435.

A volume reflecting great credit on this society, which we shall hope to review more fully later. In the meantime we will only note that few or none of the papers seem open to the charge sometimes brought against electricians of reading papers to advance private interests. All seem at first glance of real scientific value.

—*The Development of the Philosophy of the Steam Engine.* An Historical Sketch by ROBERT H. THURSTON. New York, John Wiley & Sons. 12mo. pp. 48; 75 cts.

—*Steam.* By WM. RIPPER, M. Inst. M. E., Prof. Mech. Eng. Sheffield, (Eng.) Technical School, London and New York: Longmans, Green & Co., 12mo. pp. 202, 142 cuts. Price 80 cts.

A capital little manual both in form and substance, and very cheap; quite elementary, being a reprint of a course of evening lectures delivered to a class of young engineers. It is up to date, and we do not know a better book for a man wishing to get quickly a grasp of the general principles of steam engineering as it exists to-day.

TRADE PUBLICATIONS.

—*Methods of Laying Concrete under Water.* JOHN C GOODRIDGE, Jr., 113 East 25th St., New York. Small pamphlet, pp. 15.

Describing a new patented process for depositing it in paper bags. We illustrated the process, which has decided advantages, nearly two years ago.

—*Catalogue of Steam Specialties, Standard Scales, etc.* FAIRBANKS & Co., 311 Broadway, New York. 4to. pp. 114 and 30; numerous illustrations.

This is another of the handsome trade catalogues in preparing which manufacturers now spend so much time and money, and which are evidently appreciated by their customers. This catalogue refers almost wholly to standard articles which have been long before the market, and hence calls for no special remark as to its contents.

—*Lithogen, Artificial Stone and Asphalt Pavements.* The Wohn Pavement Co., 16 Exchange Place, New York.

A very small pamphlet (too small) on a very good paving material.

SOCIETY PROCEEDINGS.

American Society of Civil Engineers.—The regular monthly meeting was held Dec. 4. The subject for discussion was Mr. FREEMAN'S paper on "The Hydraulics of Fire Streams."

Engineers' Club of Philadelphia.—The regular meeting was held Nov. 16; Vice-President ARTHUR BEARDSLEY in the chair; 25 members and 3 visitors present.

Mr. WM. B. SPENCE, visitor, exhibited a working model of the Rimmer Oxidizer, a filtering material, which he described, and for which he made various claims as to its utility in the purification of water by oxydation.

Mr. SPENCE stated that the material used is an English invention and is known as magnetic carbide of iron. It consists of a mixture of granulated iron ore and carbon. The iron ore is said to be cleaned of all natural impurities by a patented process. It is then chemically treated at a certain temperature.

It is claimed that this material will absorb and retain a large quantity of oxygen from the atmosphere. In use it is charged daily with atmospheric air, when, it is claimed, a reaction takes place with the impurities which have accumulated in the filtering material, and the result passes off in the form of gas. It is claime that metals in solution in the water will form insoluble oxides.

The upper layer of the filtering plant consists of sand, for the removal of suspended matter by mechanical filtration, and the lower layer of the material above described for the chemical removal of impurities in solution.

It is claimed that both vegetable and animal organic impurities and metallic contaminations are entirely removed by this process.

The following tests were made in the presence of the meeting: The filtering materials were contained in a large glass funnel. Water as muddy as that of the Schuylkill River during freshets was made apparently perfectly clear. A solution of sulphate of iron in water was made, and a portion thereof passed through the filter. The unfiltered and filtered portions were then tested with ferrocyanide of potassium. The former showed a distinct blue tint, while the latter remained perfectly clear, showing the elimination of the iron. Lead and copper tests seemed to show the same results.

To illustrate the destruction of organic matter, sulphide of ammonia, sulphide of iron, and acetate of lead were added to water, making a compound which was almost black and of strong and unpleasant odor. After filtering it was clear, and tests seemed to fail to discover any trace of the impurities.

A mixture of copying ink and water was passed through the filter with the same result.

HOWARD MURPHY, *Secretary and Treasurer.*

Engineers' Club of St. Louis.—Meeting of Nov. 20th, 1889. President MEIER in the chair; 39 members and 5 visitors present. Mr. ROBERT MOORE addressed the club on the subject of "Railway Culverts. "This question was usually given too little attention. The speaker described the various forms of culverts used, with the advantages and disadvantages of each; also stated the methods of determining the size and best mode of construction. He stated that sewer pipe, while admirably adapted for small culverts, should not be used over 15 ins. in diameter. For larger sizes cast-iron pipe answered well. Cast-iron pipe which had been condemned for heavy pressures, was being largely used for this purpose. Mr. MOORE also presented a diagram, based on Kutter's formula using a value of 17 for n, bearing in mind that one inch of rainfall per hour is equivalent to one cubic foot per acre per second. In the discussion, Mr. FERGUSON described a number of practical points of difficulty he had met with. The discussion was also participated in by Messrs. J. A. and W. L. SEDDON, M. L. HOLMAN and A. W. HUBBARD. Mr. HOLMAN stated that iron pipe for this purpose was being made as large as 6 ft. in diameter and 10 ft. long, being lighter and of a poorer quality than the pipe used for water service

WM. H. BRYAN, *Secretary.*

Engineers' Club of Cincinnati.—Regular meeting of Nov. 21, with 22 members present. There being no special subject for discussion, Mr. NICHOLSON entertained the club with an interesting account of his experience in driving piles for trestles in the vicinity of New Orleans, describing also the difficulties encountered in erecting buildings and other structures in and around that city on account of the marshy soil on which it is built.

The Tacoma Society of Civil Engineers and Architects has been organized in Tacoma, Washington. The present officers are—President, H. S. HUSON; Vice President, ARTHUR L. SMITH; Secretary, WM. S. GOSSLYN; Treasurer and Librarian, CHARLES F. WHITE. There are already 42 charter members, and before the expiration of the next three weeks they hope to have 60 members. Another set of officers will be elected at the annual meeting in January, 1890.

The New England Water Works Association will hold its regular quarterly meeting on Dec. 11, 1889, at Young's Hotel, in Boston. The chief paper to be read and discussed will be "Experiments and Practical Tables, relating to the Discharge of Fire Streams, and the Loss of Pressure by Friction in Hose," by JOHN R. FREEMAN, C. E., of Boston.

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Coming Technical Meetings.

Engineers' Club of Philadelphia, Pa.—Next meeting, Dec. 7. Secy., Howard Murphy, 1122 Girard St.

Civil Engineers' Club, Cleveland, O.—Next meeting, Dec. 9. Secy., C. O. Palmer, 32 Cedar Ave.

New England Railway Club, Boston, Mass.—Next meeting, Dec. 11. Rooms in the United States Hotel.

Civil Engineering Society (Inst. of Technology), Boston, Mass.—Next meeting, Dec. 12. Secy., Clement March.

Western Railway Club, Chicago, Ill.—Next meeting, Dec. 17. Rooms in the Phœnix Building.

Engineers' Society of Western Pennsylvania.—Next meeting, Dec 17. Secy., S. M. Wickersham, Pittsburg, Pa.

Boston Society of Civil Engineers.—Next meeting, Dec. 18. "Ventilation of School Buildings," Wm. E. McClintock. Discussion on "Ventilation." Secy., S. E. Tinkham, City Hall.

American Society of Civil Engineers, New York.—Next meeting, Dec. 18. Annual meeting, Jan. 15. Secy., John Bogart, 127 E. 23d St.

Engineers' Club of St. Louis, Mo.—Annual meeting, Dec. 16. Address of the Retiring President, E. D. Meier. "The Spreading of Contagious Diseases by Railways," J. C. W. Belcher, Secy., W. H. Bryan, 809 So. 7th St.

Western Society of Engineers, Chicago, Ill.—Next meeting, Jan. 1. Secy., J. W. Weston, 78 La Salle St.

Engineers' Club of Kansas City, Mo.—Next meeting, Jan. 6. Secy., Kenneth Allen, 200 Baird Building.

New York Railway Club.—Next meeting, Jan. 16. Rooms at 113 Liberty St.

THE President's message contains reference to an unusual number of points of engineering interest, but among them all there is none more truly important and hopeful than the following, referring to car coupler accidents which we reprint in full:

The attention of the Interstate Commerce Commission has been called to the urgent need of congressional legislation for the better protection of the lives and limbs of those engaged in operating the great interstate freight lines of the country, and especially of the yardmen and brakemen. A petition, signed by nearly 10,000 railway brakemen, was presented to the Commission, asking that steps might be taken to bring about the use of automatic brakes and couplers on freight cars.

At a meeting of State Railroad Commissioners and their accredited representatives, held at Washington in March last, upon the invitation of the Interstate Commerce Commission, a resolution was unanimously adopted urging the Commission "to consider what can be done to prevent the loss of life and limb in coupling and uncoupling freight cars, and in handling the brakes of such cars." During the year ending June 30, 1888, over 2,000 railroad employes were killed in service, and more than 20,000 injured. It is competent, I think, for Congress to require uniformity in the construction of cars used in interstate commerce, and the use of improved safety appliances upon such trains. Time will be necessary to make the needed changes, but an earnest and intelligent beginning should be made at once. It is a reproach to our civilization that any class of American workmen should, in the pursuit of a necessary and useful vocation, be subjected to a peril of life and limb as great as that of a soldier in time of war.

For nearly twenty years the Master Car Builders' Association has held its annual conventions for the purpose of adopting uniform mechanism in the freight equipment of this country. It settled upon the dimensions of axles, the height of rail to the centre of drawhead, etc., but the most difficult problem before it was that of a uniform type of coupler. Three years since, out of the 3,000 appliances that had been presented and patented, they had succeeded in making selection of six link and pins and six vertical hooks, and finally, at their meeting in 1887 at Minneapolis, they voted by a large majority to settle upon one single type, namely, a vertical hook of the Janney type, and their action was finally confirmed by letter ballot, covering the great majority of railway interests in this country, since which time, the majority of all the great trunk lines, in the East as well as in the West, have been putting this type of coupler on to all new freight equipment.

These roads have taken the matter up without legislation, and have invested a large amount of money in these appliances, which must eventually result in the great saving of life and limb which is referred to above in the President's message. But of course these railroads cannot expect to receive the great benefits intended until the branch lines, and in fact, all roads, shall have adopted this type of coupler. There is no reason to-day why any freight car should be built without using some one of the numerous devices which couple with one another according to the M. C. B. type. In fact, any road putting on other couplers is in truth simply wasting money, because nothing is more certain than that it will be obliged to conform to the M. C. B. standard in the end; but many roads still hang back, and will hang back as long as they dare and can, and a little compulsory legislation by Congress, to help these weak brethren to decide and act promptly, is greatly to be desired, if it can only be rationally framed.

NEW YORK's chance of selection by Congress for the holding of the Exposition is greatly increased by the completion of the guarantee fund of $5,000,000, in connection with the fact that the site also is practically secured, and is an undeniably good one, although not, in our judgment, the best that could have been selected. An enlarged Governor's Island would have been an ideal site even for a single exhibition, and with the added advantage that the buildings would all be permanent, would greatly beautify the harbor, and would be ready for decennial exhibitions thereafter, which could then have been held at very small cost. We fear, however, that it is too late for this. The best must now be made of the site selected, on which all buildings must be temporary, but which is a grand and beautiful one. Should the exhibition be well planned and carried out, we shall look with confidence to see an enormous attendance, probably rising close to 40,000,000, especially if the price of admission be fixed at 25 cts., charging double rate before 2 or 3 P.M., and if the buildings be kept open till midnight and brilliantly illuminated. The last will quite certainly be done, and will alone almost double the attendance. There will also be a strong pressure to have the exhibition open on Sunday; and if there be no machinery in motion, the demand will probably be acceded to. Whatever objections there may be to this,—and they are very weighty, apart from the religious objections,—there can be no doubt that it will be a boon to the hundreds of thousands who can ill afford to take week-days for attendance, will afford them a healthful and refining mode of passing Sundays, and will very largely add to the number of visitors. We note that Congress is not even expected to act in the matter until after the Christmas holidays.

THE Paris police have afforded us a needed basis for estimating the probabilities of attendance at a World's Fair by the following estimate of the attendance at Paris, which is no doubt very close to the facts. Out of the total attendance of 25,000,000 in round numbers, the police estimate that there were:

	Visitors.	p. c.
Of Parisian residents	18,500,000	74.0
" French provincials	5,000,000	20.0
" Foreigners	1,500,000	6.0
Total	25,000,000	100.0

Of the foreigners, 115,000 only, or less than half of one per cent., are estimaetd to have come from North and South America together. The table shows that our estimate of last week—that from one-third to one-half of the visitors might be expected to come from the outside world—was over-liberal. No city has drawing power on the outside world at all comparable to that of Paris, and similarly, no city on this continent has drawing power on the outside world at all comparable to that of New York; but allowing to New York and Chicago equality in this respect, and allowing that the readiness of Americans to spend money and to travel would more than make up for the inferior attracting power of the cities named, so that a third instead of a quarter of the attendance would be from the outside world, the three millions of metropolitan New York against the one million of Chicagoans practically assure an attendance in New York at least double what it would be in Chicago.

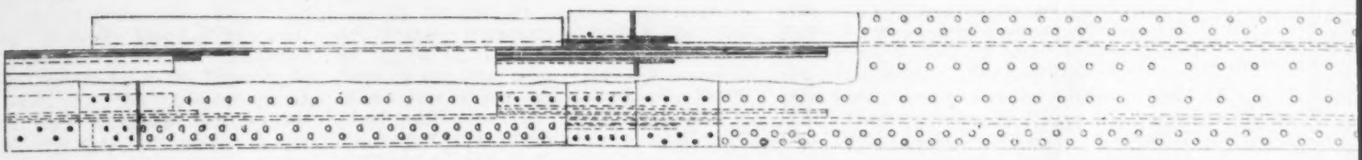
THE extraordinary material growth of this country is indexed in a striking way by some comparative figures given in the first part of the Postmaster General's report. The growth of the postal system, which now has in its employ 150,935 persons, is exhibited by the following little table.

Year	Post offices	Lgth of routes (miles).	Millions of stamps issued.	Postal cards.	Money orders.
1874	34 300	270,000	632	91	$74,400,000
1880	43.000	344,000	876	273	100,300,000
1889	58,999	416,159	1,962	387	115,081,845

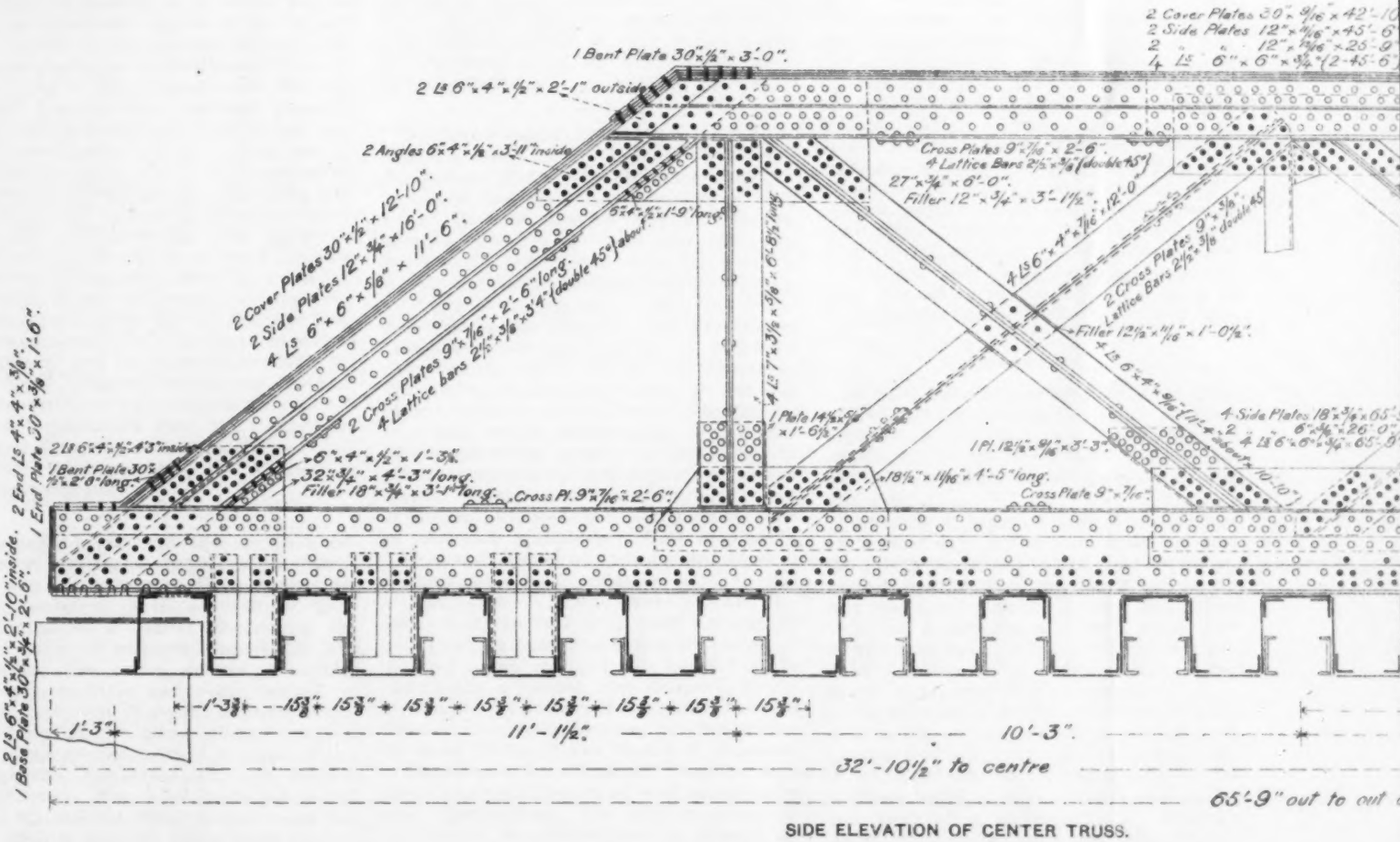
It is to be remembered that between 1880 and 1889 (in 1883, if we remember correctly) the rate of postage was reduced from three to two cents but there has been no other radical change of conditions, and the percentages of increase compare as follows;

Increase in	*Offices*	*Routes*	*Stamps*	*Postals*	*Money Orders.*
1874-80 6 yrs.	8,700	74,000	244	182	$25,900,000
1880-89 9 "	15,999	72,159	1,086	114	14,781,845
Per cent incr					
1874 80 6 yrs.	29.3	27.4	38.6	200 0	34.8
1880-89 9 "	37.2	21.0	124.0	41.8	14.7

During these periods the population probably increased some 18 and 28½ per cent. respectively, at the usual decennial rate of 32 per cent., and the enormous increase in the average use of the post-office per head is at once evident. It is a curious commentary on the intelligence with which the daily press is consulted—or perhaps of the careless indifference of the average reader—that but one newspaper in this city, the *Tribune*, reproduced these most significant of all the figures contained in the report.

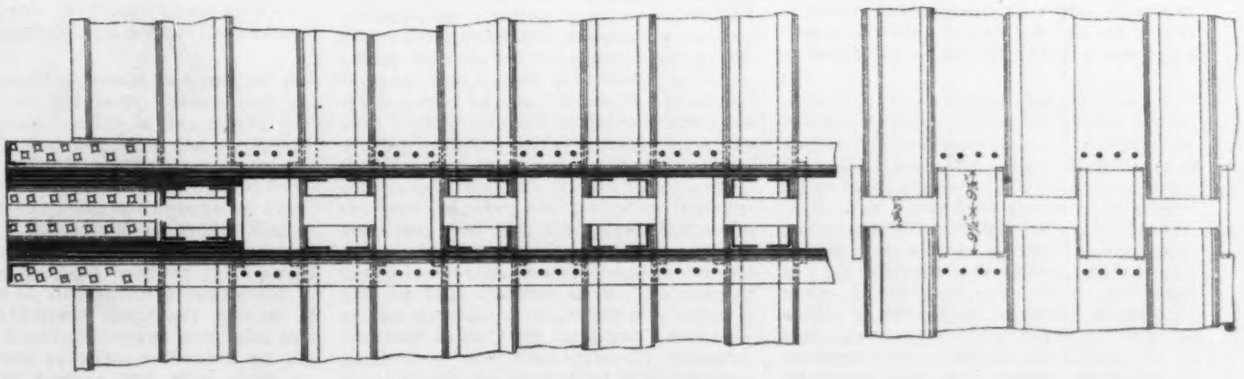


PLAN OF TOP CHORD.

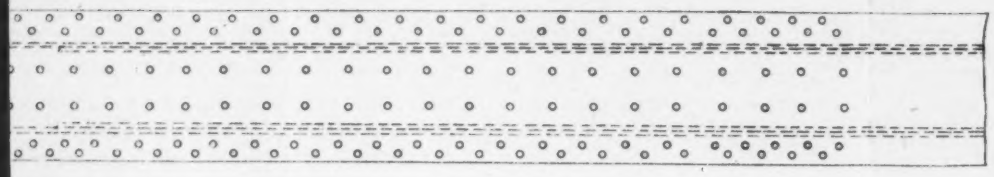


SIDE ELEVATION OF CENTER TRUSS.

(TWO OUTER TRUSSES OF SIMILAR DESIGN, LIGHTER MEMBERS.)



PLAN OF FLOOR.



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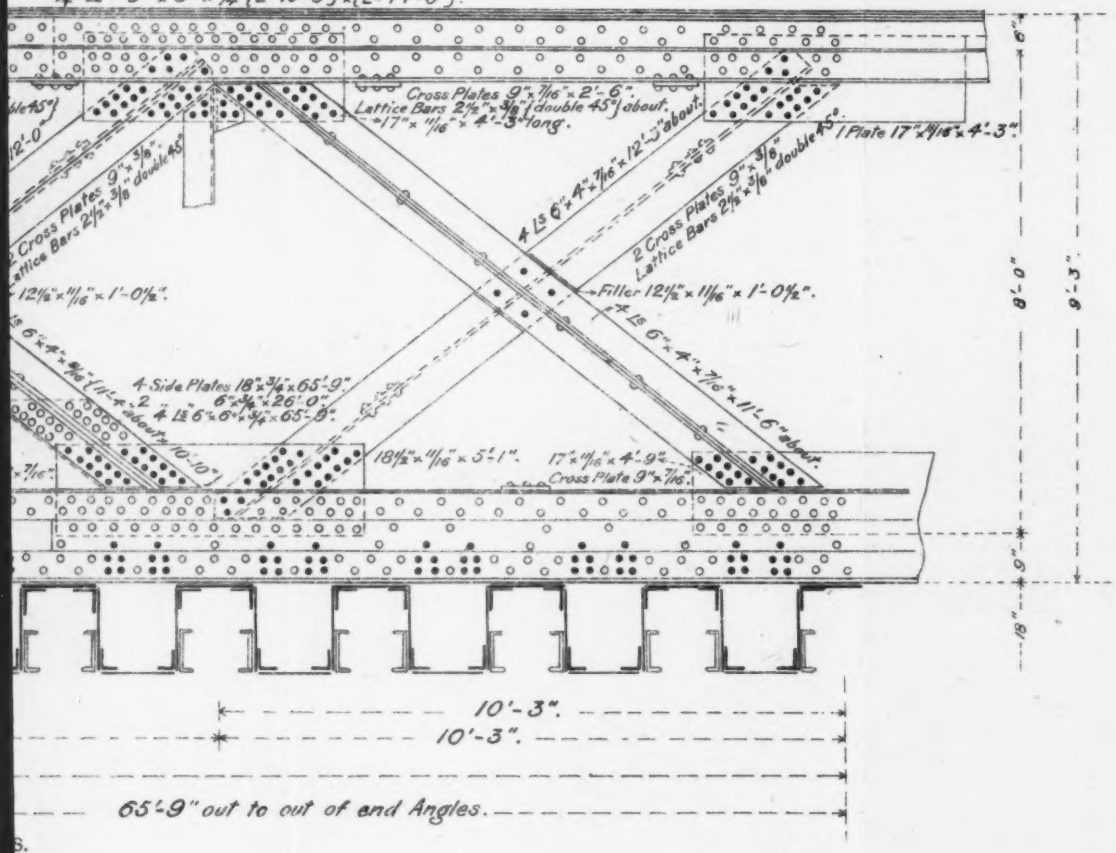
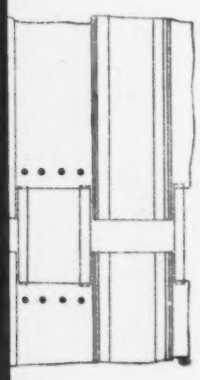
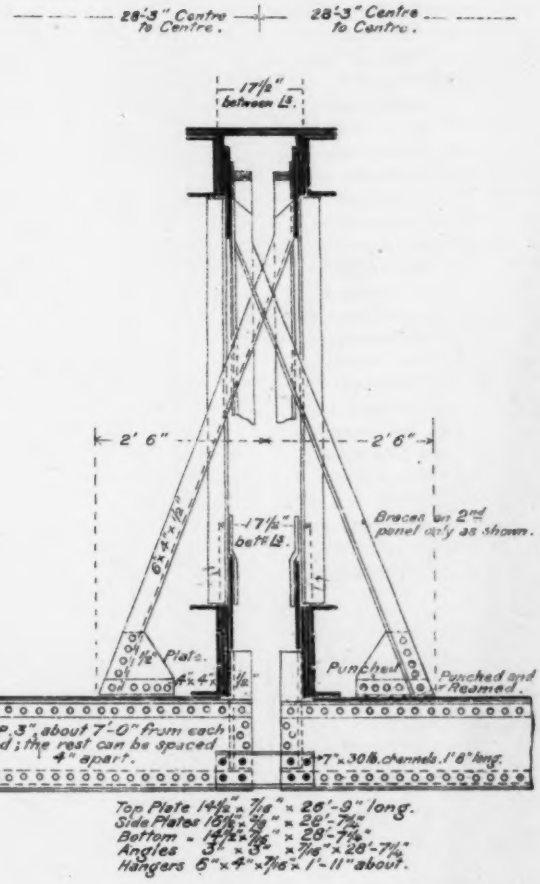


S.

MEMBERS.)




28'-3" Centre to Centre.
28'-3" Centre to Centre.
17½" between Ls.
2' 6"
2' 6"
17½" betn Ls.
Bracon on 2nd panel only as shown.
Plate.
Punched
Punched and or Reamed.
B.P. 3" about 7'-0" from each end; the rest can be spaced 4" apart.
7" × 30 lb. channels. 1' 6" long.
Top Plate 14½" × 7/8" × 26'-9" long.
Side Plates 16" × 7/8" × 26'-7½"
Bottom " 14½" × 7/8" × 26'-7½"
Angles 3½" × 3½" × 7/8" × 26'-7½"
Hangers 6" × 4" × 7/16" × 1'-11" about.

CROSS SECTION.

ORISKANY BRIDGE,

NEW YORK CENTRAL AND HUDSON RIVER RAILROAD.

GEO. H. THOMPSON,
ENGINEER OF BRIDGES.

WALTER KATTÉ,
CHIEF ENGINEER

CHAS. HART & SONS, LITH. 38 VESEY ST. N. Y.

THE Grand Jury of this city sits down with a thump upon the New York Subway Commission in its November presentation, and it also pays its respects to the Board of Electrical Control in recommending that the whole electric system be turned over to the Department of Public Works. The chief argument against the present mixed arrangement is that existing State laws permit any corporation to tear up the streets at will, after merely going through the formality of obtaining a departmental permit. Streets may be dug up day after day by different companies, "whereas one such opening could, under proper supervision, be made to answer for several purposes." The Grand Jury very properly suggests that all tearing up of street surface should be under the control of the Department of Public Works, and should be done by the department upon application and under a deposit to cover the estimated cost. Subways are also recommended, wherever possible, which shall include ample space in one tunnel "for gas, steam, and water pipes, and for wires, traction cables, etc." The presentation concludes by saying that the Grand Jury is of the opinion—and a sound opinion it is—that it was a grave error to intrust such important interests to a commission or board "having no practical acquaintance with the subject of electricity, either theoretical or applied." The Jury also believes that the Board of Electrical Control has been "negligent as well as incompetent, and is largely responsible for the slow and unsatisfactory manner in which the wires are being removed from the streets," and it recommends that this board be abolished as soon as possible, and the control of electric subways and service intrusted to competent supervision.

WE heartily concur with this emphatic expression of opinion on the part of the Grand Jury, and have several times before expressed ourselves on the absurdity of inexpert control of a matter demanding the highest order of technical knowledge and experience. The entire scheme of burying the electric wires, as now being carried out in New York, was originally a politico-commercial venture, set afloat without previous study of the requirements of the case, or any well-digested, comprehensive, and efficient plan of action. The commission put in control of this all-important matter seemed to think that a hole in the ground, through which a cable could be hauled, was the beginning and the end of their mission; and if they have at last succeeded in getting into a hole themselves, they must blame their own utter incompetency, and not the Grand Jury, for it.

The best street pavement that man can devise is but a wicked waste of money and labor, if its surface can be broken at will, day after day, by any one of a dozen corporations. While much can be done to lessen the degree of this mischief by putting all work of this character under one responsible head, such as the Department of Public Works, necessary extensions and repairs would still require a too frequent breaking up of street surface and an ever-occurring obstruction to traffic and business under any system of small, individual subways as now being laid down. Roomy subways, containing all the underground pipeage and wires liable to change or extension, undoubtedly offer the only means of preserving the integrity of the pavement; and while such subways, in our main arteries of business only, would cost enormously, they would be economical in the end. The lifetime of the present pipe-subways is a limited one, and the safety and efficacy of the contained cable is yet a doubtful quantity. It is only reasonable, therefore, to assume that all the present miles of pipe subways are merely a temporary makeshift that must be ripped up and thrown on the scrap-heap in the near future, with the complete obliteration of the capital invested. Under these conditions, the jury's suggestion of large subways is sound advice; and it would probably be well to consider their cost and plans of construction along with the proposed rapid transit investigation, when that subject reaches the body of experts to whom, we hope, it will be speedily submittted. Underground railways would doubtless be considered, and subways enter vitally into such consideration. But in the meantime let the laws be so changed that the control of all that is now going on may be put into hands better fitted to bring about the best results under present conditions.

THE improvement of the highways of Rhode Island is asked for by the State division of the League of American Wheelmen, and it is evident that these same wheelmen have kept their eyes open in traveling over the highways referred to. The memorial summarizes the good roads, notes the location of stone-crushers and steam-rollers, and calls attention to the pertinent fact that while large cities, like Newport and Providence, have each one commissioner of highways only, Scituate has 70 surveyors of highways; Burrillville, 46; Gloucester, about 47; and four other towns have about 37 each. The remark that such minute independent subdivisions of responsibility cannot be productive of the best results is very sound; as is the further remark that "working out" taxes at the rate of 15 cents per hour is not the kind of labor that is likely to produce good roads. The memorial goes on to show that there is an undoubted legal obligation on town and city authorities to furnish good roads, and proceeds to explain that good roads are cheaper in the end, in maintenance and in decrease of tractive power required. In support of the arguments advanced, the memorial is accompanied by a neat reprint of MR. CLEMENS HERSCHEL'S well-known essay on "The Science of Road Making" and Capt. F. V. GREENE'S, "Nature and Uses of Asphalt," together with some practical remarks on road maintenance and legislation, etc. The latter is the important part of the memorial and is given in the form of a bill ready for legislative action.

AGITATION of this kind is healthy, and by concentrating attention upon a condition of things which everybody knows all about, but nobody seems to feel is worth combating individually, much good can finally be done. While it may be charged that the wheelmen have a selfish interest in improvement upon existing methods, what is their interest is also the interest of every user of roads in the State, and we trust that the present vigorous effort to arouse the public and inaugurate improvement may meet with the success that it deserves. But in regard to the bill prepared, it is very evident that there is too much overseer and too little engineer in it. An overseer elected annually by the voters of a township and paid $2 per "day employed," and independent of any other authority whatever, is not exactly the kind of an official wanted, when, as is the case in most States if not in Rhode Island, "road improvement" practically means the relocation of old and the construction of new roads; nor is the knowledge gained in one year's service even sufficient to properly care for old roads.

An overseer, as an executive officer in each township, may be a very good thing; but he wants a master in the person of a skilled engineer, who shall control the general system of highways throughout a county, for example, and be responsible for their proper design and construction. The provision in the bill permitting the overseer "to employ a competent engineer, when he deems this necessary," is just a little bit absurd; for it provides for very limited engineering supervision, and really leaves the well-intentioned, but perhaps technically very ignorant, overseer to decide when this engineering is necessary. We fail to find in the bill any requirements as to fitness on the part of the overseer. This bill as it stands would simply divide the highways of the State among a number of overseers, corresponding to the number of townships in the State, independent of each other and of any higher authority. It is in fact that same "minute subdivision" of responsibility pointed out and objected to in the memorial, and it is entirely lacking in that permanent and efficient technical control which is absolutely necessary for any real and economical improvement. Rhode Island is a small State, and one competent engineer could easily supervise the construction and maintenance of every road in it. It is an excellent State in which to make a beginning in this direction. We advise our friends to try again at the legislative end of their very laudable project.

AT the last meeting of the New York Railroad Club some remarks were made concerning subjects for discussion at the meeting and certain statements which were made, doubtless without careful thought, deserve a little criticism.

One speaker, in giving some reminiscences of the early days of the club, remarked that the things which are talked over nowadays had all been discussed and fought over in former years, and that the present discussions were only a repetition of those in which older members of the club had already taken part Others spoke as if there were a great dearth of live subjects for discussion.

This position is a very absurd one. While to a certain extent, the old subjects do reappear in new forms, the fact is that the topics which most interest railway men to-day had not been heard of, save perhaps as theoretical possibilities, a decade ago. Standard axles for 60,000-lb. cars, compound locomotives, the use of oil fuel, heating from the locomotives, standard automatic brakes and couplers with their connecting gear, abolition of grade crossings, and other live subjects of discussion to-day, had no interest, had hardly existence, for the railway men of fifteen years ago.

Nor is it to be thought that the number of subjects on which interesting papers can be written and profitable discussion carried on is at all limited. One danger, however, is to be earnestly avoided. Arguments over mere matters of dimensions are, as a rule, thoroughly uninteresting, whether the subject discussed is an axle or an engine. Important as such matters are, they are not suited to interest an audience, and their discussion should be carried on, whenever possible, by committees. It is to be hoped, too, that the movement for a broader field of work will be successful, and that matters pertaining to rolling stock of every class, to permanent way, and even to traffic, may be discussed by the club. Every railway official should take an interest in and be able to discuss intelligently, not only the work in his own department, but the work in other closely related departments.

The Lesson of the Boston Fire.

Within the short space of a week the country has been startled by two great conflagrations, causing a property loss of nearly $11,000,000, and by two fires of minor importance as regards the property loss, but serious in destruction of life. In these fires probably 14 lives were lost. The sum of fatalities at Boston and Lynn will probably swell the total number of lives lost by the four fires to 20.

The rapid succession in which these disasters have followed each other, and their occurrence under such widely diverse circumstances is doubtless a mere coincidence; but it will be at the same time a most fortunate one, if it impresses upon the public the urgent need of providing some more efficient means of fire protection than those now in use. If the same disasters had occurred at intervals within a month instead of a week, comparatively little impression would have been made upon the general public.

The Boston fire directs especial attention to the danger which exists in the business districts of our larger cities, where, within the past decade, buildings of great height have been put up, many of them with too much regard for outer and inner finish and too little regard for the safety of the property and its contents. The Minneapolis and Philadelphia fires, with their sad fatalities, will serve to impress, as no mere money loss could do, the need everywhere for greater care in construction and vigilance in protection.

We fully discussed in an editorial in our issue of Jan. 19, 1889, the grave question of our increasing fire loss, which now amounts, including the expense of maintaining our fire protective and insuring agencies, to about $175,000,000 per year. It was shown in that article that, according to the lowest estimates, it would be an act of wisdom to make an increase of 41⅔ per cent. in the cost of buildings other than dwellings in the whole United States, if we can by that expenditure make them practically safe from fire. Since this is the average for the whole United States, it follows that in the crowded business districts of the large cities, where such sweeping conflagrations as the recent Boston fire are possible, a much greater increase in the expenditure on the original construction would be justifiable as an economical measure simply.

What can be done to decrease the fire loss by the use of the so-called slow-burning construction, combined with a proper system of fire protection, is shown by the reports of the Boston Manufacturers' Mutual Insurance Co. Mr. C. J. H. WOODBURY, in his paper on "Methods of Reducing the Fire Loss," read at the recent meeting of the American Society of Mechanical Engineers, said, "The cost of insuring industrial property engaged in such normally hazardous processes as textile manufacture and other industries has been reduced [by the Mutual Insurance Company's methods] to a yearly cost of less than one-fifth of one per cent. . . . It has thus been proved that it is cheaper to prevent a fire than to sustain a loss." The average annual loss by fire in the United States is about one-half of one per cent. of the total value of the property subject to combustion. But as the hazard on textile factories, as ordinarily constructed and managed, is much greater than on the average property, the saving effected by the common sense methods of the above organization is probably at least three-fifths of one per cent. annually on the total value of the property.

The point to which we in this country need to pay greatest heed is the reform of our methods of construction. Solid blocks of buildings, four to seven stories in height, cover the business districts of our large cities; and no matter how nearly fireproof the materials of which they are constructed, they are pretty certain to contain enough woodwork and inflammable merchandise to produce a conflagration, provided the spread of the flames be sufficiently rapid. It is not always realized that the principle which underlies all fireproof and slow-burning construction is: delay the progress of the flames, and the heat from the combustion is radiated fast enough to prevent the fire spreading. Accelerate the rate of combustion, and it spreads and gathers fresh fuel faster than that already ablaze is consumed.

To make a building fireproof, therefore, it is necessary simply to make its floors and partitions of such incombustible material that a fire in any room shall be confined to that room, or shall spread from it but slowly. The great defect in many so-called fireproof buildings is the distance between the fireproof partitions. Too large floor spaces are left, with only thin partitions between them, through which a fire rapidly makes it way. For mercantile establishments, large, open floor spaces with the floors above supported by iron pillars are exceedingly common; they would be less so if the danger in which they place the whole building were better understood. This is one principal reason why a building devoted to offices, even when built with no more care, is safer from burning than a store or warehouse. The rooms in the latter are large enough to permit a good-sized fire to get started in a single room, while the office building consists of a much greater number of closed parts, none of which are large enough to permit a fire to gain any considerable headway.

But it is by no means feasible to divide up the space in warehouses or mercantile establishments to the extent which is done in an office building; and the former is often built to receive goods of highly inflammable nature. The great point to be sought, therefore, is to prevent the spread of the fire. The best means of effecting this seems to be an ample supply of shutters and doors closing automatically in case of fire. The efficacy of these devices when properly applied has been proven in very many cases. At the recent Lynn fire, the Tebbitts Block, a building to the windward of and in the direct path of the fire, was saved solely by the fire shutters. A two-story wooden building, separated only by a ten-foot alleyway from the Tebbitts Block, sent its flames directly against the building and finally fell over against it, and a high brick building just beyond the wooden one also sent its flames toward the exposed block. The shutters were the standard adopted by the Mutual Factory Company, of wood covered with tin; and though the heat was so intense that the tin was melted off the outer plates, men were able to work behind the shutters and apply water to extinguish the flame as it came in at the exposed edges.

A well-built brick wall is a very effectual barrier to the spread of a fire. But outer walls must of necessity be pierced for windows, and inner walls must have more or less doors. These openings give a ready means of passage to a fire. Such a closely built up section as the dry goods district in this city should have in each block many heavy brick walls, pierced with the fewest possible openings, and each opening provided with a double automatic fire door.

If the business section of any great city were to be built anew in this manner, we should have little need to fear conflagrations. But such a rebuilding is out of the question, unless, indeed, it be forced by a fire's clean sweep. We must make shift to protect our cities as they stand,—districts in which shaky old buildings, veritable fire-traps, are scattered thickly among well-built structures, safe enough if they were not exposed by their shabbily built neighbors, but wholly unable to withstand a general conflagration, and certain to add to it when once ablaze, by the combustion of the goods stored within.

The recent Boston fire has turned general attention to the dry goods district in this city, and the constant risk, which has for years been present, of a conflagration there. This district covers about 100 acres, and estimating the value of the buildings alone at $500,000 per acre, the total property at risk in this district is probably not less than $400,000,000 and is very likely much more than this. The height of the buildings, the great areas of open floor space, and the amount of inflammable material with which the structures are stored, makes it quite certain that a fire once under full headway in this district would extend itself so rapidly that the whole available force of the New York fire department could not check its course.

The only feasible mode of giving adequate protection to this district, as it stands, is the introduction of an auxiliary system of water supply mains of a capacity ample to pour upon a conflagration a much larger quantity of water than that now delivered from the fire engine nozzles, and these streams, experience amply shows, should be delivered from a roof hydrant service. Reports of Mr. JOHN R. FREEMAN, to the Boston Manufacturers' Mutual Insurance Co., show that the roof hydrant service on the buildings of R. H. White & Co. and C. F. Hovey & Co. were of great value in checking the spread of the flames at the recent Boston fire, although the stream used was but 1⅛ in.

In *Van Nostrand's Magazine*, for March 1884, a plan was submitted by Mr. FRANCIS B. STEVENS for the protection of the New York dry goods district by a scheme under which four streams with a total flow of 12,700 galls. per minute, equal to the volume delivered from 70 fire engines, could be quickly concentrated in any one spot in the whole dry goods district. The plan was well marked out, and had much to commend it, it being quite certain that its "root idea" is the best one for protecting such specially dangerous areas. The plan proposed the laying of duplicate 24 in. mains through all the streets of the dry goods district, to be supplied with water by pumps on West St., taking steam from boilers with a combined capacity of 1,280 H. P. At the intersection of each street would be four hydrants, from which the streams could be taken. The important feature of the plan, however, is the use of 8-in. standpipes, two at each street intersection, rising to the top of two of the corner buildings. At the top of each would be a stationary play pipe with a 3⅛ in. nozzle, capable of being directed toward any point. This play-pipe would be capable of throwing, with an available head at the nozzle of 228 ft., 3,175 galls. of water per minute, reaching to a horizontal distance of 404 ft., whereas the present standard nozzle only throws 180 galls. per minute to a distance of 75 ft.

A similar plan in many features was submitted in 1880, by EDWARD ATKINSON, for the protection of the Boston dry goods district, but it did not involve the use of the enormous play pipes suggested by Mr. STEVENS. Mr. ATKINSON's estimate of the cost of such a protecting plant was less than $2,000 per acre. Mr. STEVENS estimated the cost of his

proposed system at $620,000, or a little over $6,000 per acre.

If we suppose that the average amount at risk in the New York dry goods district is only $2,000,000 per acre, and that the average rate of insurance is only 1 per cent., and that the reduction in the rate by the installment of Mr. STEVENS' plant would be only ¼ of 1 per cent. (all exceedingly low estimates), the saving in one year in reduced insurance payments alone would be almost sufficient to pay the expenditure in putting in the whole plant. Surely, in this case protection is far cheaper than running risks; yet so foolish is mankind that we fear this common-sense precaution will be neglected until some great disaster has proven too late its importance.

The standard nozzle now used in New York, as above stated, has a diameter of 1¼ ins. and will throw a stream to a height of 75 ft., thus delivering about 180 galls. per minute; but of even this small quantity, only a small portion reaches the fire. The experience with the large 2-in. stream, thrown from a water tower into which two or three engines pump, shows that it is much more effectual in extinguishing a fire, and a much larger proportion of the water pumped reaches the flame. Large streams go in a solid mass to the heart of the fire, and are less affected by air currents. They are able to force their way through loose partitions, windows, and other obstacles, which often prevent most of the water thrown by the smaller nozzle from reaching the flames. There is no doubt that modern practice tends to the use of larger streams for extinguishing fires wherever the capacity of the apparatus will permit it.

We used not discuss here the details of Mr. STEVENS' plan or of those of others which have been suggested. The plain facts are that several hundred million dollars worth of property around us is exposed to great danger of destruction by a conflagration against which, when once started, our present means of protection would be impotent. It has been shown that it is perfectly feasible from an engineering standpoint to make this district, and similarly situated districts elsewhere, far more secure than the average business property, at a cost which would be paid in less than two years' time by the saving in insurance premiums.

A matter of such grave importance to a city's commercial prosperity should be attended to before the mischief is done. If the city authorities will not move in this matter, there seems to be an opportunity for a private company to make enormous profit by furnishing this much-needed protection; or it might even well be done by united action on the part of the property owners or insurance companies whose interests are at stake.

Certainly a practicable enterprise, offering such profits and advantages in every way, should be taken up and carried through by some interest without delay. If it is not done, those whose property is at stake will in time have reason to regret it, in ashes if not also in sackcloth.

It is now fifty-four years since New York has had a great conflagration. Other cities about us have meanwhile been visited, and unless some more efficient means of fire protection is adopted here, our turn may come at any day. The occurrence of a storm much inferior to the great blizzard of 1889 would again make the streets virtually impassable to fire engines and might thus furnish the necessary conditions for a conflagration unparalleled in the world's history. To sum up in a word, is it not plain that to protect the concentrated millions of property in the heart of our great cities from destruction by fire, we should no longer rely entirely on the puny streams furnished by portable engines, which by various accidents may be prevented from reaching the fire. To check the progress of a conflagration, a great quantity of water is needed, and this can be most safely, economically, and certainly furnished by stationary pumps forcing water into mains of ample size, from which it can be obtained, whenever and wherever needed, by the turn of a valve.

The South American Republics.

The remarkable peaceful revolution in Brazil, which has recently astonished the world, is especially notable as extinguishing the last relic of monarchical institutions in this hemisphere, except that Canada still remains a part of the British Empire, that British Honduras and British and Dutch Guiana are still controlled by their respective European Governments, and that most of the West Indian and other islands are still controlled by the nations which originally took possession of them some centuries ago. These exceptions are so unimportant, and in the case of Canada at least, so unmeaning, that the whole continent of North and South America may now said to be self-controlled by governments "of the people, by the people, and for the people."

And it is a most significant evidence that such government is the coming type for the whole of civilized mankind, that not alone the United States, but all the other republics of this continent, have been making marvellous progress in the past quarter of a century. It is not to be denied that for half a century prior to this period there was little or nothing in the conditions prevailing in any of the numerous republics on this continent, apart from the United States, to encourage belief in the permanency or the advantages of republican institutions; and when our civil war came to throw a cloud over our prospects also, it is not surprising that even the most liberal-minded of European statesmen felt that there was something like a universal break-down of popular methods of government.

Since then a marvellous change has come about, not alone in this country, but in almost all the independent States of North and South America, tending to show that in all the greater republics, and not only in this country, the discouraging features were but temporary, and that the permanent forces were steadily working for civilization and good government. The most notable example of this tendency, or at least the one best understood in this country, has been that of Mexico. Mexico went through a most disheartening period of almost complete anarchy; but it has now for more than twenty years enjoyed a stable and on the whole excellent government. It has not been without abuses, but it has been steadily improving, and it has shown an enlightened interest in the material development of the country which has borne and continues to bear great fruit. The day of revolution and anarchy in Mexico is plainly over forever, even if there should yet be some single temporary collapse.

The same is even more emphatically true of the two republics in the extreme south, Chili and Buenos Ayres, or the Argentine Republic. Chili has enjoyed a stable government since 1833, and is and has long been a wealthy, progressive, and well-governed country. Its population is still small, only 2,500,000 or thereabouts, but it is advancing very rapidly in every element of civilization.

This is still more true of the Argentine Republic, a great country which has over half the area of the United States, but which had only 2,000,000 population in 1869, which is claimed to have been about doubled since, mainly, of course, by heavy immigration. This country has enjoyed complete internal peace since 1873, and for twenty years before that date it was in a fairly peaceful and well-governed condition. It is now advancing in every element of civilization with great rapidity, and the Argentine Republic and Chili between them are also rapidly settling Patagonia, which is proving to be a country of no small capabilities.

The republics nearer to the equator, Peru, Ecuador, Venezuela, and the numerous small States of Central America, are not advancing so fast, nor have they yet reached so high a state of industrial civilization as the countries to the north and south of them. The first necessity for the Central American States, Nicaragua, Costa Rica, Guatemala, San Salvador, and Honduras, is the organization of some form of federal union, and it is significant of the real progress which they are making that such a union appears to be on the point of consummation. While the condition of these countries is not all that might be desired, that their condition is growing steadily better is too plain for denial. The same is true of all the equatorial South American republics. Their progress is painfully slow, but they do make progress, their governments being now comparatively stable, and showing an increasing tendency to promote the material development which must always come before a high state of civilization in other respects is possible. Of Venezuela this is particularly true.

Brazil, the latest accession to the long list of republics, has somewhat more than the area of the United States, or 3,288,000 sq. miles, and somewhat over 10,000,000 of population, or about the same as that of Mexico. No stronger single evidence that the country has in it the capability of self-government could well be given than the unprecedented way in which this great revolution was effected; not by violence, not by discourteous or ungrateful conduct toward the deposed ruler, who had deserved well of his country, not by abuse in any way (which has as yet appeared) of the absolute power suddenly vested in unaccustomed hands, but by a plain, business-like recognition of the fact that, while the Emperor should no longer be permitted to reign in a country which had outgrown such personal government, he should not be driven away empty-handed, nor his adherents persecuted and robbed of their property, nor his contracts on behalf of the State ignored. A harder blow at the whole theory of personal government by divine right was never struck. Had the revolution been effected by violence, it would have been vastly less effective; and we may hope that an example has been set which will be followed in all succeeding revolutions, of which the world is likely to see many in the next few decades. That Brazil will be most beneficially affected by the change in government, and that there will be far more rapid progress hereafter than there has been heretofore in the development of her vast resources, we fully believe. It is the fashion to think and speak of tropical countries as incapable of a high civilization, and it may be so; but the fact that, for the last thousand years or so, the development of tropical countries has been comparatively slow does not by any means prove it. Two thousand years ago a still stronger argument might have been made from the state of things in the then world, that countries like England, Denmark, Sweden, and Russia were too far north for any but a rude civilization.

CORRESPONDENCE.

Timber Trestle, Wheeling & Lake Erie R. R.

Wheeling & Lake Erie Railway Co.,
TOLEDO, O., Nov. 22, 1889.

TO THE EDITOR OF ENGINEERING NEWS:

Apropos of the various plans of timber trestles that have been presented and discussed through your columns, there is enclosed a plan of trestle in use on this road. This plan, while not embracing fully the "cluster" idea, is a departure from the solid member style. It was designed by the Chief Engineer, Mr. C. A. WILSON, with a view to placing the timber so as to avoid decay, and at the same time to have it firmly built and convenient for the maintenance and renewal of defective members. It has been the experience of this road that timbers in trestles have had to be renewed after a very few years' service, on account of decay at abutting surfaces, necessitating the removal of pieces that are entirely sound, except at perhaps a single point. This is particularly true as to the caps of bents and the stringers, the latter being, on account of size, the most expensive and difficult to obtain. This is the reason for placing the stringers in the method shown, and this question is worthy of more consideration than is often accorded it. The mileage of railroad track resting on timber and pile trestle in this country is hardly realized, nor is its condition. Timber is being taken out every day on railroads all over the country, by the mechanics engaged in the work of maintaining such structures, in such bad condition that the puzzling question is how it performed its service. All bolts are of the same dimension iron, for the reasons before stated, and all nuts are locked by a wrought spike driven through the washer.

Yours truly,
C. A. SHACKFORD,
First Asst. Engr.

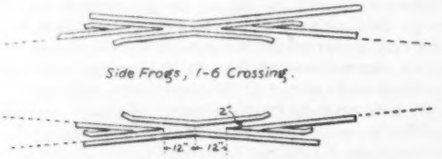
[This design has many things to commend it. We cannot fully approve the arrangement of the floor, but defect in that detail is chronic, even with bridges, and still more with trestles. The split caps and sills are a detail which we have often recommended, and we fully agree that it is far better to increase the number and decrease the size of all the members of wooden trestles, and to make them all independently renewable, the material being subject to such insidious deterioration, against which it is extremely difficult to guard effectively. —ED. ENG. NEWS.]

The Elimination of Facing Point Switches.

CHICAGO, Nov. 12, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

In regard to my communication to you under the above head in your issue of Nov. 16, my views on this subject, after further thought, are somewhat modified: the main objection is that the wide frogs of the crossing or slip lie opposite each other, and if the guard rails are 2 ins. from the track rails, there is left on a 1 to 6 angle a distance of 12 ins. on either side of the point where the wheels cannot be guided (see sketch herewith) As 1 to 6 is about the best angle for a crossing without movable points, it might be unsafe to run trains over such frogs



Side Frogs, 1-6 Crossing.

at high speeds, and a worn flange or narrow truck might take the wrong direction; so after all there is in each of these frogs a facing point about as dangerous as the one I wished to avoid, and the difficulty remains as before. Do you consider this sufficient to kill the plan? Thanking you for your attention, I am,

Yours truly,
X. P. T.

[Despite the difficulty noted, the plan would seem to offer certain advantages for localities suited to it. Facing points *per se* are not particularly objectionable. It is when they are in the main rails, and likely to be passed over at speed, that they become objectionable. They are then highly so.—ED. ENG. NEWS.]

The Duty Test of the Pearsall Hydraulic Engine.

LONDON, E. C., Nov. 22, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

I notice some correspondence about the Hydraulic Engine in your paper for Nov. 2.

Your reply is conclusive as far as it goes, but I shall be obliged if you will allow me to make a further reply by way of explanation of the misconception of your correspondent.

The error he has fallen into is that when deducting 125 x 17.25 from the work done, he forgot to deduct a similar quantity from the other side of the equation. If he does this, he will find the result very nearly the same by his method as by that of Mr. POTTS. Mr. POTTS' method is, however, the more correct and the more practically useful, as the efficiency of any engine is universally defined as the ratio between the work done and the power exerted.

Moreover, being the true expression of the efficiency of the engine, it indicates the result attainable in other cases, as where other water than the power water is pumped, or where the engine is used for compressing air.

You remark that friction in the pipe has nothing to do with the efficiency of the machine. I take it that that is correct as regards the delivery pipe (which, of course, may be any length desired), but that friction in the pipe leading to the machine is properly regarded as part of the friction of the engine, as was done by Mr. POTTS.

Yours truly,
H. D. PEARSALL.

Aluminum for Engineers' Instruments.

PITTSBURG, Pa., Nov. 26, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

We note in your last issue the editorial reference to the use of aluminum for transits and levels. We thank you for the attention you have called to the metal for this purpose, for which it is eminently adapted. If for any reason any manufacturer has a particular part of the apparatus he wishes to test the use of aluminum in, we should be glad to furnish the aluminum for a trial free of charge.

Very respectfully,
THE PITTSBURG REDUCTION CO.
ALFRED E. HUNT, *President.*

[We renew our offer to manufacturers of instruments to give the fullest publicity to any advances which they may make in the use of aluminum. With aluminum only $2 per lb., not to speak of the chance that it will go lower, the time has come, in our judgement, when field instruments should be entirely made of it, or of some of its alloys. Sensible purchasers will willingly pay the extra price, which should be only a few dollars.—ED. ENG. NEWS.]

Notes as to Railway Field Work.

MINNEAPOLIS, MINN., Nov. 23, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

I have been following with increasing interest the articles on "Railway Field Work," etc., and noticing that you are giving generous space to suggestions, I beg to offer the following.

On general principles I take exceptions to the first seven ways in which it is said that geometric precision is neglected as unimportant, in the Oct. 26 issue, for the following reasons: 1. The young engineer (from the fulness of the article I take it that he is being addressed) does not need any warning in regard to using too exact methods, but rather the reverse. He should be impressed with the necessity of using them (exact methods) until coming to actual work, when he is to determine, from a thorough appreciation of the work and from the degree of accuracy required (which, of course, differs widely for different classes of work), what small errors may be allowed and what must be corrected. And since this may depend quite as much upon the character of the errors themselves (cumulating or compensating) as upon the class of the work, I believe no general rules can be given which will be at once safe and beneficial to the engineer, and if given they will be harmful, as encouraging rough and approximate methods,—a direction in which, at present, no stimulus seems needed. It is very easy to pass from rigid discussions and precise methods of execution to thumb rules and "short cuts," and the discriminating engineer must do it, and can do so easily and safely, understanding his work; but to pass from approximate to exact methods is not so easy. The one is down grade the other up, to use a railway term.

In the second place, I object to the second and third of the seven paragraphs above referred to on the ground that in good practice all fractions of a foot in distance or seconds of arc in angles are not neglected. Nor do I believe that any careful engineer would attempt to keep a transit in such nice adjustment as not to need reverse sights in running long tangents, or indeed in doing any of the transit work of careful location. The band chains, which are growing in favor with the profession, make it as easy to read the nearest tenth as formerly to the nearest foot with the link chain.

The same general criticism I would offer on the measurement of angles, since our transits are usually graduated to read to 30", and some to 20", and all verniers, whether graduated to read finer than minutes or not can be easily read to the nearest half minute.

In number 7 of the paragraphs, the engineer is told that "the station stakes between plugs are not set precisely on line," which of course is true, and it is likewise true of even the tacks in the hubs; but if the best results are to be gained in a piece of work, we would not expect to gain it by informing the engineer that he could not do it right if he tried.

I do not wish to say, in general, that the competent engineer would not often do just what is outlined in the paragraphs in question, and greater precautions might be needless in particular cases; but I believe it unsound doctrine to give to all.

In a word, it is a matter of discrimination, and not until the engineer is thoroughly acquainted with all of the details of the work is he able to exercise such power of discrimination, much less to profit by instruction in it.

Under chaining I would note the following, which is suggested by five seasons of field service in railway work and the same amount of time in instruction in the field operations of railway work and land surveying.

Of the many methods used to avoid errors in numbering stakes, I have found the following to give the best results. Have but two stakes marked at a time; then the one of less number is stuck, and another marked the next higher than the stake remaining. This avoids confusion and delay, which is sure to come when 30 or 40 stakes are marked in advance, and places the responsibility upon one instead of two, as with other methods.

In chaining, my experience has been that large errors are more likely to occur from a confusion of the marking pins than in any other way.

This I find can be almost wholly avoided by having the head chainman put a pin at the point of beginning; then, at any time during the measure, the rear chainman holds in his hand the number of pins corresponding to the number of chain-lengths measured. This necessitates eleven pins, of course, and allows one to remain at the end of each ten chains, while with ten this point must be "kept track of" during the change and until the next chain's length is measured.

Then, on slopes, by using a pin at each point of "break," the same as at the end, and the rear chainman handing to the head chainman—as he comes up to take the chain at the point of "break"—one pin in exchange for the one left marking the point of "break" not at the end of the chain, and continuing this exchange until the pin is placed at the end of the chain; the rear chainman retains that one as if it had been taken up at the rear end of the chain.

While this method is in no way novel, I feel sure the rigid use of it would diminish very much the errors coming from a loose use of the marking pins.

X.

[We have been expecting to receive some such letter as this; the author had the probability fully in mind when penning the paragraphs objected to. Beginning from the end of the letter, and passing the question as to the proper method of chaining with pins as one not relating to railway field-work, (although we agree with "X"), the method of marking stakes one at a time which he proposes, so that only two marked stakes are on hand at any time, is one absolutely without countenance in general practice. It would result in cutting down the progress of a lively transit party nearly one-half. The established rule in practical field-work is to mark at each transit point, while the instrument is coming up, enough stakes to run to the next transit point at least, and usually quite a number more. It is not found that any delay or confusion results. The worst that can result is the occasional transposition of a stake, which is detected and corrected by the level, and this very rarely happens.

That our correspondent should "not believe that any careful engineer would attempt to keep a transit in such nice adjustment as not to need reverse sights when doing any of the transit work of careful location" is unfortunate, for the fact is that they not only "attempt" to do it, but do do it; so that double reversions are an unheard-of thing in practical work except when special nicety is desired, as in running a very long tangent.

What "X" quotes as to not recording pluses to fractions of feet or central angles to fractions of minutes is not quoted quite fairly. He implies, in fact asserts, that more was asserted than was asserted; but as he evidently objects to what was in fact said, that point may be passed.

Coming then to the general question, our correspondent's position is a correct one, that in the first training of young men, either in mathematics or in

field-work, it is highly important that they should be thoroughly drilled in methods of *absolute precision*. But just as a treatise on theoretical mechanics is one thing and on practical mechanics quite another thing, so a treatise on field-work designed only for class-room drill is one thing, and one designed as a guide to the practical work of the field quite another thing. The author is writing what professes to be a manual of field-work "according to the most recent and approved practice *on American railways*," not in American class-rooms. The only pertinent issue as to any statement is, therefore: Is it approved practice? and not: May it lead some foolish young man to out-Herod Herod?

The milk-for-babes theory, that a certain thing may be true but is dangerous in its tendencies, would be a poor guide for preparing such a work. No man is too young or too inexperienced to be told a truth which concerns him, nor can it do him real harm, although he may well be harmed by having the facts of good practice concealed from him. How well the author has succeeded in recording good practice must be left for the future to decide; but so far as an experience of over twenty years in charge of some thousands of miles of railway location can indicate the truth, the author regards the paragraphs objected to as not only teaching the truth, but as teaching important truths, which cannot be contravened without detriment to good practice.—ED. ENG. NEWS.]

Formulae vs. Formulas.

IOWA CITY, IA., NOV. 19, 1889.

TO THE EDITOR OF ENGINEERING NEWS:

In your issue of Nov. 16, under a notice of E. SHERMAN GOULD'S work on Practical Hydraulic Formulæ, etc., you state that the use of the word "formulæ" is not in good taste when used as an English word, etc. While admitting that "formulas" is an English plural of "formula," still preference is given to "formulæ" by the majority of literary authorities and by the most eminent of modern technical writers. Therefore I would be pleased to know through your columns upon what authority you make the statement that it "is not good taste," and trust your correspondents will govern themselves accordingly. Yours respectfully,

C. D. JAMESON.

[Undoubtedly authority can be found to support the use of the Latin plural, but authority can also be found in favor of the English form. We based our position upon taste and not upon authority; and although we should enjoy writing a column of philological argument, nevertheless, remembering the old proverb *De gustibus non disputandum*, we refrain. However, if "formulæ" is Latin and "formulas" is English, as our correspondent admits, no one can object if we use the latter.—ED. ENG. NEWS.]

Notes and Queries.

C. B. S., of Dennison, O., asks for the address of the Pittsburg parties who proposed to precipitate sewage by electricity, as noticed in our issue of Feb. 11, 1888. Can any of our readers give the information?

A. C. B. There is a very large number of engineering and architectural societies in the United States, and we could not even undertake to give you a full list of them, still less the names of the secretaries. We published what was then a full list on July 11, 1885. We have not undertaken to compile one since. Numerous technical societies are reported in our pages from time to time.

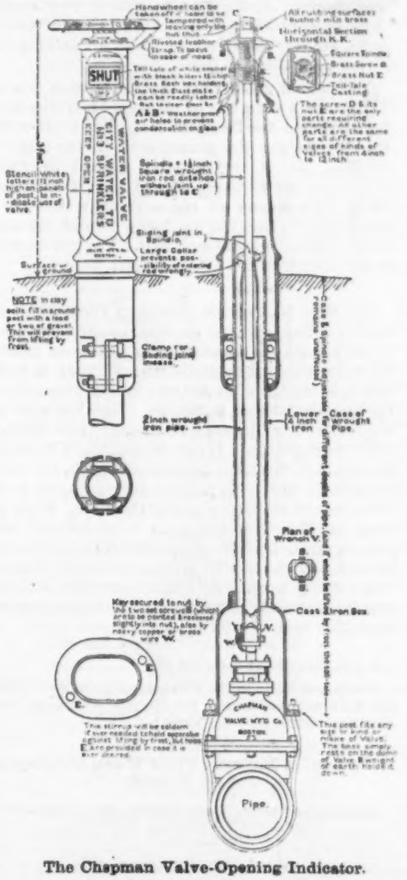
J. S. S., of Camden, N. J., asks what is the best "tool" for making measurements in cities,—a combination rod, patent chain, or steel tape? All of the above are open to certain objections, either from inconvenience in use or, chiefly, liability to rust. A brass tape is a good thing; but, probably owing to trouble in graduating it, this tape is not on the market. Aluminum and its alloys defy rust, and in practice such a metal should possess all the good qualities of a Chesterman steel tape. The instrument maker who first introduces this new metal in a serviceable measuring tape will find a ready and profitable market.

H. W. N., Alexandria, Va., queries our statement as to value of certain New York property, as given in ENGINEERING NEWS of Oct. 26, and asks if the price named includes buildings. It does not. The buildings are old, and on land quoted at nearly $9,000,000 per acre these buildings count for naught.

THE CHILIAN GOVERNMENT, says a Santiago item, has forwarded $310,000 to Europe to contract for and bring workingmen to Chili, under its contract with the South American Contracting Company.

The Chapman Valve Opening Indicator.

The device here illustrated shows in a very complete manner a new valve-opening indicator manufactured by the Chapman Valve Mfg. Co., of Indian Orchard, Mass. Its very essential purpose is to indicate by simple inspection the position of the valve, whether open or shut. The illustration, which is reduced from a much larger one, tells nearly all there is to say about it, and is in itself an



The Chapman Valve-Opening Indicator.

excellent example of a cut sent out with a new device to indicate its make and purpose. A somewhat similar device, intended especially for use with interior "sprinklers" and hydrants for fire protection, was illustrated in our issue of April 27, 1889 as patented by Mr. DANIEL KELLY, of 52 Cliff St., New York. The Chapman Indicator is provided with a permanent opening key and is particularly serviceable for use with underground water or gas valves in mill-yards, etc., outside of buildings.

Another Chicago River Tunnel.

The West Chicago Street Railway Co. is going to build a tunnel under the Chicago River about 150 ft. north of Van Buren St. for the accommodation of two cable tracks. It will be of brick masonry, and 30 ft. wide in the clear by 15 ft. 9 ins. high above rail level. The tunnel will be 1,513 ft. long, and will commence at the west line of Franklin St. with a grade downward of 10 per cent. until the center of the river is reached, where the elevation of track will be 52 ft. below street grade; from this point the grade will ascend to the street level at the east line of Clinton St. on the west side of the river. The tunnel will be on private property, and will pass under all buildings on the line, which must be maintained and supported during the construction of the work; it will also pass under the tracks of the Pittsburgh, Fort Wayne & Chicago, the Chicago & Alton and the Chicago, Burlington & Quincy Railways at the entrance to the Union Depot; on this account the work presents exceptional difficulties, and will probably take three years in its construction. The same company is also rebuilding and lowering the old Washington St. Tunnel under the river, which work will be completed in about two months, and will also be used for the cable roads. When these two works are finished, the annoyance and loss of time consumed by crossing the river on street cars will be overcome and will be of great benefit to the citizens of the West Division of the city. The Engineer is Mr. S. G. ARTINGSTALL, M. Am. Soc. C. E.

A New Great Engineering Project.

The inhabitants of the Isle of Man having, like the rest of the world, caught the "Tower Fever," are at present exciting themselves with a scheme for uniting one side of Douglas Harbor, situated on low ground, with the other, which is formed by a precipitous rock know as Douglas Head.

The scheme consists in building up a tower 450 ft. in height on the lower side of the harbor and connecting it at an elevation of 200 ft. with the higher side by means of a viaduct.

The lower portion of the tower up to a height of 200 ft. will be 172 ft. in diameter, and will consist of two concentric rings formed of wrought iron columns and braces. The inner ring will be about 92 ft. in diameter, and the annular space between the two rings will be occupied by a spiral roadway 40 ft. in width laid to an easy gradient for vehicles and foot passengers. At an elevation of 200 ft. the spiral roadway will communicate with the viaduct which is to be carried across the harbor on to Douglas Head.

Rising from the top of the circular tower will be an elegant, spire-like structure, which will be carried up to an elevation of 450 ft. above ground surface. It will be constructed of light steel ribs and will be surmounted by a light-tower and an observatory.

The upper portion of the circular tower will form a large circular promenade with a band-stand in the centre, while within the tower itself will be a concert hall and rooms for various entertainments.

The viaduct, which is to be utilized as a high-level promenade, will consist of four spans supported upon wrought iron piers. The longest span will be 400 ft. and placed over the entrance to the harbor, giving a clearance at highest spring tide of about 150 ft. It is a great and interesting project, which we trust may be carried through.

Mr. JOSEPH GORDON, late Surveyor and Engineer to the London County Council, England, died on Nov. 9. Mr. GORDON was born in 1836; was articled in 1853 to the late Mr. HOGG, City Surveyor of Carlisle; and was the efficient assistant of Mr. RAWLINSON when that gentleman, as chief engineer, built the sewerage works of Carlisle. He was later an assistant of Mr. RAWLINSON in carrying out sewerage work in the district of West Ham, London. From this place he was elected in 1860 to the office of Surveyor of Carlisle, and held this position for about six years. His experience and reputation in sanitary engineering was now such that his advice was sought upon a number of engineering works in the north of England and in Scotland. From 1866 to 1873 he was engineer of important sewerage works at Frankfort-on-Main, in connection with other large undertakings. As consulting engineer he was later connected with the sewerage of the cities of Stuttgart, Heilbronn, Munich, Hanau, Nuremberg, Dortmund, Bockenheim, Laudshut, Homburg, Aix-la-Chapelle, etc. He was borough surveyor of Leicester in 1880, and only a few weeks ago was appointed the Chief Engineer to the Metropolitan County Council. Mr. GORDON was a member of the Institution of Civil Engineers, of the Institution of German Engineers, and of the Institution of Architects and Engineers and the Technical Society of Frankfort. Too close application to the work of his profession doubtless hastened his death.

A Colored Mathematical Prodigy.

SAM SUMMERS, the negro prodigy, was in town yesterday, and as usual entertained a large crowd, who were testing him with all kinds of mathematical problems. SUMMERS is a negro, 34 years old, without the slightest education. He cannot read or write, and does not know one figure from another. He is a common, every-day farm hand, and to look at him and watch his actions he seems to be about half-witted, but his quick and invariable correct answer to any example in arithmetic, no matter how difficult, is simply wonderful. With the hundreds of tests that he has submitted to, not a single time has he failed to give the correct answer in every instance.

Some examples given him on yesterday were: How much gold can be bought for $792 in greenbacks if gold is worth $1.65? Multiply 597,312 by 13½. If a grain of wheat produces seven grains, and these besown the second year, each yielding the same increase, how many bushels will be produced at this rate in twelve years if 1,000 grains make a pint? If the velocity of sound is 1,142 ft. per second, the pulsation of the heart seventy per minute, after seeing a flash of lighting there are twenty pulsations counted before you hear it thunder, what distance is the cloud from the earth, and what is the time after seeing the flash of lightning until you hear the thunder? A commission merchant received seventy bags of wheat, each containing three bushels, three pecks, and three quarts; how many bushels did he receive? And so on.

With Robinson's, Ray's, and other higher Arithmetics before them, those who have tested him as yet have been unable to find any question that with a few moments' thought on his part he is not able to correctly answer.—*Louisville Commercial.*

Tests of Aluminum Alloys.

Prof. TETMAJER, of the Polytechnic School of Zurich, has lately made a series of tests on alloys of aluminum and copper with regard to their mechanical properties. The results given in an exchange are as follows:

Alloy.	Al. added per cent.	Tensile strength. Kilos. per sq. millimeter.	Tensile strength. lbs. per sq. in.	Elongation per cent.
Aluminum bronze	11.5	80	113,784	0.0
" "	11.	66	90,696	1.
" "	10.	64	90,026	11.
" "	9.5	62	87,283	19.
" "	9.	57.5	81,782	32.
" "	8.5	50	71,115	5:.5
" "	5.5	44	62,581	64.
Aluminum brass	4.	69	98,139	6.5
" "	3.	60	85,338	7.5
" "	2.5	52	73,980	20.
" "	2.	48	68,270	30.
" "	1.5	45	64,004	39.
" "	1.	40	56,892	50.

A curve of results, as plotted by Prof. TETMAJER, shows that with increasing percentages of aluminum the tensile strength of the alloy increases slowly at first, and then rises rapidly as the lighter metal is added. As a means of comparing the effect of this addition of aluminum to the copper, it might be here remarked that the ultimate tensile strength of copper wire, the strongest form, is 32,000 lbs. annealed and 60,000 lbs. unannealed per square inch. Hard or annealed brass wire has an ultimate strength of 80,000 lbs., and unannealed, of 49,000 lbs. per square inch. By comparing these standards, as given by TRAUTWINE, with the above table, it will be seen that even a small percentage of the aluminum wonderfully adds to the tensile strength of the baser metal.

The Magnetic Iron Ore Mountains of North Sweden and the Ural.

A German engineer in a late issue of the *Zeitschrtft des Vereines deutcher Ingenieure*, compares the magnetic iron deposits of Sweden and the Ural Mountains. The most remarkable Swedish mines are those in the Kirrunavara and Luossavara mountains in 68° N. lat. These mountains are separated by a lake about 3,000 ft. wide, and the first named mountain rises in a bold ridge about 670 ft. above the plain and extends north and south about 2½ miles. The ore is exposed in cliffs often several hundred feet high, and it yields from 62 to 73½ per cent. of pig-iron, and contains 0.04 per cent. of phosphorus in the northern and southern parts, and 1 3 per cent. in the middle. The deposit is about 700 ft. thick in the broadest part and the estimated quantity of ore contained in it is 82,127,000 tons in the exposed part, 174,331,700 tons above the level surface but covered by gravel, and it is likely to yield about 460,000 tons for each foot in depth sunk over the area.

The Luossavara Mountain is similar in general character, but less imposing in development. The exposed range is computed to contain 27,656,000 tons, says a translation of this article in the "Abstracts" of the Inst. C. E., and the yield per foot of sinking is put down at about 73,000 tons. The ore is, however, much purer, yielding 70 to 73 per cent. of pig-iron, while the phosphorus is reduced to 0.008 per cent. In both deposits, therefore, there is about 85,000,000 tons of ore of the highest Bessemer quality available above the level of free drainage; but to bring them into the market an extension of the Lulea Ofoben Railway will be required.

The magnetic iron deposits of the Siberian Ural, unlike the unutilized ore of Sweden, have been worked for more than 150 years. The most important of these, the Blagodat, is at Kuschwa, a station on the Perm & Jekaterinburg Railway. It was discovered in 1730 by a certain PUTSCHKIN, who sold his discovery to the Russian Government for half-a-guinea, and was afterwards burned alive by the Wogul natives, who feared that the introduction of mining would lead to their expulsion.

The deposit, though once higher, still rises 500 ft. above the Saloa River. It is very pure magnetite (65 per cent.) in porphyry, and is very free from phosphorus. At the present time it only supplies three blast-furnaces at Kuschwa. The surveys and maps are very imperfect, and data are lacking even to estimate the quantity.

The second great Ural deposit is near Nischne Tagil, on the same line of railway. It is longer and broader than the Blagodat mine, but is practically exhausted above the ground-level in the magnetic portion. It is very actively worked by Prince DEMIDOFF for furnaces at and near Iekatarinenburg. The bottom of the working is now 200 ft. below the surface, the ore being hauled out along spiral roads by horse and cart. The ore contains 65 per cent. iron and 0.05 of copper.

THE NEW HAMPSHIRE FORESTRY COMMISSION has been holding sessions at Manchester. Chairman WALKER said the value of farms and farm stock in the State amounts to $90,000,000; railroads, $110,000,000; manufactures, $50,000,000; annual income from the lumber interest, $4,500,000. Now has come the summer visitors' interest, the income from which in 1888 was $2,500,000. If the mountains of the State are denuded, this latter interest must fail, and something must be done to prevent the cutting off to the detriment of other interests of the State. Sixty per cent. of New Hampshire is now covered with forests. Only 1,000,000 of the 6,000,000 acres are now plowed and the whole acreage of arable lands is only 2,000,000 acres. Addresses have been made advocating the State securing control of the mountain lands now covered with forests.

A CORRESPONDENT writes us:

Does it pay to take the ENGINEERING NEWS? I have this week received orders for analysis netting me $100, the direct outcome of the NEWS!

A Manual of Railway Field Work and Laying Out of Works.

ACCORDING TO THE MOST RECENT AND APPROVED PRACTICE ON AMERICAN RAILWAYS.

BY A. M. WELLINGTON,
M.Am.Soc.C.E., M.Inst.C.E., etc.

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[The author will be pleased to receive typographical or other corrections, or suggestions as to form or substance, from any interested reader. All such suggestions will have full consideration.]

CHAPTER II. THEORETICAL PRELIMINARIES.

[*Continued from* p. 523.]

The difference between a parabolic and a circular arc connecting the same tangents and tangent points, *P* and *T*, Fig. 22, lies simply in this; that a parabolic arc bisects the radial line *I A* perpendicular to the chord *P T* in *B*, whereas a circular arc always falls inside of the parabola by some distance *B B'*, it having been already demonstrated (§) that *I B' > B' A* in all cases. To determine *B B'* we have:

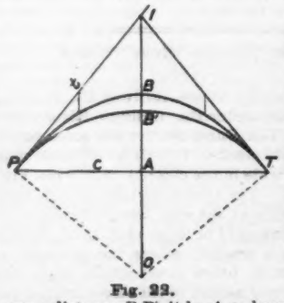


Fig. 22.

$$B\,B' = \tfrac{1}{2}(I\,B' + B'\,A) - B'\,A = \frac{I\,B - B'\,A}{2}$$

whence for a 1° curve, we have

$$B\,B' = \frac{E\text{-}S_1 - M\text{-}O_1}{2}$$

From this equation, using the values of *E-S*, and *M-O*, in Tables 12 and 14, the following values of *BB'* in feet may be deduced for various values of *I*:

I =	10°	20°	30°	40°	50°	60°	90°
BB' =	.045	0.67	3.45	11.05	27.80	59.35	347.55

The differences of position, and hence of radii, between a circle and a parabola, are trifling up to 40° or 50°, but beyond that increase rapidly.

TO DETERMINE THE PRECISE EXTENT OF THE DIFFERENCE IN RADII which would result from using a parabolic instead of a circular arc to connect two given tangents *P I*, *I T*, Fig. 22, we have the following:

The radius of a parabola at its tangent points, *P* and *T*, is given by the formula[1]:

$$R_p = \frac{t^2}{A}$$

in which *A* = area of triangle *P I T*, and *t* = *P I*. But, by geometry, $A = t\cos\tfrac{1}{2}I \times t\sin\tfrac{1}{2}I$

$$= t^2\cos\tfrac{1}{2}I\sin\tfrac{1}{2}I$$

whence (Table 48):

$$A = t^2\,\tfrac{1}{2}\sin I$$

whence

$$R_p = \frac{t}{\tfrac{1}{2}\sin I}$$

The radius of a circular arc to connect the same tangent points is

$$R_c = \frac{t}{\tan\tfrac{1}{2}I}$$

whence

$$\frac{R_c}{R_p} = \frac{\tfrac{1}{2}\sin I}{\tan\tfrac{1}{2}I}$$

Or, remembering that the degree of the curve is inversely as the radius, and letting D_c and D_p = the degrees of curves corresponding to the above radii:

$$\frac{D_p}{D_c} = \frac{\tfrac{1}{2}\sin I}{\tan\tfrac{1}{2}I}$$

or

$$D_p = \frac{\tfrac{1}{2}\sin I}{\tan\tfrac{1}{2}I}\,D_c \qquad (\ )$$

Similarly, for the difference in radii at the central point *B* or *B'*, we have

$$R'_p = \frac{c^2}{A}$$

But, from the figure, $A = c^2\tan\tfrac{1}{2}I$, whence

$$R'_p = \frac{c}{\tan\tfrac{1}{2}I}$$

For the circular radius, R_c in terms of *c* we have

$$R_c = \frac{c}{\sin\tfrac{1}{2}I}$$

whence

$$\frac{R'_p}{R_c} = \frac{\sin\tfrac{1}{2}I}{\tan\tfrac{1}{2}I}$$

Or, in terms of the degree of curve instead of radius

$$\frac{D'_p}{D_c} = \frac{\tan\tfrac{1}{2}I}{\sin\tfrac{1}{2}I}$$

and

$$D'_p = \frac{\tan\tfrac{1}{2}I}{\sin\tfrac{1}{2}I}\,D_c \qquad (\ )$$

Letting $D_c = 10$, we may compute by Eqs. ( ) and ( ) the following table, showing precisely what changes in terminal and central curvature would result from substituting a parabola for a circle of various central angles, *I*, both curves connecting the same tangent points:

Value of I	*Degree of curvature of parabola substituted for a 10° curve consuming various central angles.* At centre of curve	At ends of curve
10°	10.04° or 10° 02'	9.92° or 9° 55'
20°	10.15° " 10° 09'	9.70° " 9° 42'
30°	10.35° " 10° 21'	9.39° " 9° 23'
40°	10.64° " 10° 39'	8.89° " 8° 50'
50°	11.03° " 11° 02'	8.21° " 8° 13'
60°	11.55° " 11° 33'	7.50° " 7° 30'
70°	12.21° " 12° 12'	6.71° " 6° 43'
80°	13.05° " 13° 03'	5.87° " 5° 52'
90°	14.14° " 14° 09'	5.00° " 5° 00'

It will be seen that for curves less than 60° long the amelioration at the ends of curves is small, while for curves longer than 90°, the central curvature becomes objectionably sharp.

Whenever the vertex of the parabola, *V*, Fig. 15, is not included within the given arc, which will occur whenever the angle *B I T*, Fig. 23, is over 90° (if it be precisely 90° the point *T* will be the vertex,) the curvature will increase slowly from one *P. C.* to the other, and the whole supposed advantage of the parabola for railway use disappears. Fig. 23 shows to scale an instance taken from Henck's Field-Book (p. 72). The degree of curvature at ends or centre of curve is determined in the same formula as already given, Eq. ( ).

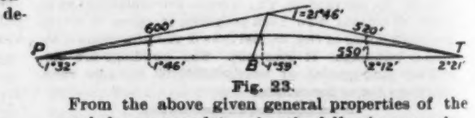


Fig. 23.

From the above given general properties of the parabola, we may determine the following very im-

[1] For demonstration see "Field Book for Railroad Engineers" by JOHN B. HENCK, by whom this formula was first demonstrated, p. 73.

portant and fundamental theorem in relation to the circle:

ANY CIRCULAR ARC COVERING A MODERATE CENTRAL ANGLE DEFLECTS FROM ITS TANGENT SUBSTANTIALLY IN ACCORDANCE WITH THE LAW OF THE PARABOLA, OR AS THE SQUARE OF THE DISTANCE FROM THE TANGENT POINT.

Let P, 1, 2, 3, 4, Fig. 24, be a circular arc tangent to $P A$, and let the points P, 1, 2, 3, 4, be equidistant and, for simplicity, 100 ft. apart. Lay off from P successive equal angles, APa, aPb, etc., which ($\S$) will pass through these points. Through each point on the curve draw the lines d 1, e 2, etc. to A 4, perpendicular to PA, and with radius P 4 strike the arc A' 4.

Fig. 24.

Then will the lines a b c divide the arc A' 4 into equal parts, and also the perpendicular A 4 *nearly*. Furthermore, since the points 1, 2, 3, 4 are equidistant, the parallel lines d 1, e 2, etc. will likewise be equidistant *nearly*. But if the lines d 1, e 2, etc. were exactly equidistant, and the perpendicular A 4 were exactly subdivided, the arc 1, 2, 3, 4 would be a parabola.

The extent of the error in regarding the circular arc as a parabola is decreased by the fact that the two errors just noted are compensatory. It may be determined thus: (1) The points a b c 4 fail of equidistance by the extent to which the sines of small angles are not proportional to the angles themselves. The tendency of this error is to throw each successive point on the circle higher and above where a true parabola would lie, but the error for small angles is small. Thus for various circular arcs from 2° to 30° long, we have, as the comparative value of the sine per degree of deflection angle, the following table:

Central Angle.	*Deflection Angle.*	*Sine of Deflection Angle.*	*Ratio of Sine to Angle.*
2°	1°	.01745	.01745
10°	5°	.08716	.01743
20°	10°	.17365	.01736
30°	15°	.25882	.01725

On the other hand, we have: (2) A compensating error, tending to throw the circular arc below where a true parabola would lie, in that the parallel lines $d1$, $e2$, $f3$, $A4$, Fig. 23, are not in fact equidistant, but grow continually smaller, owing to the fact that the successive equal chords $P1$, 1-2, 2-3, 3-4, etc., are at a continually increasing angle with the tangent. Thus the successive small rectangles, $3f$ $4c$, tend to grow smaller in all their parts as the distance from the tangent point is greater, and hence to maintain in the curve its similarity to a parabola.

The approximation is so close that for arcs not over 10° long, the circle and the parabola are practically identical, and for arcs up to 30° long, the approximation is as close as is ordinarily required in practice for the purpose in view, as will be seen by examples to be given after establishing the two following equally important theorems:

ANY TWO PARABOLAS HAVING A COMMON TANGENT AND TANGENT POINT, AND COMMON DIRECTION OF DIAMETER AND TANGENT OFFSETS (as the curves A B C D and A' B' C' D', Fig. 25) DEFLECT FROM EACH OTHER BY THE SAME LAW BY WHICH EACH DEFLECTS FROM THE COMMON TANGENT, OR AS THE SQUARE OF THE DISTANCE FROM THE COMMON TANGENT POINT.

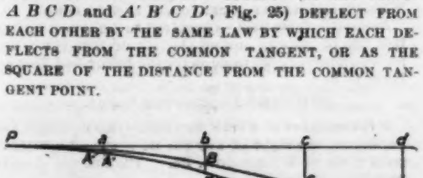


Fig. 25.

For we have as the successive deflection offsets for the first curve A D, by Eq. ( ):

$$1a,\ 4a,\ 9a,\ 16a,\ \ldots\ n^2\ a,$$

and correspondingly for the second curve

$$1a',\ 4a',\ 9a',\ 16a',\ \ldots\ n^2\ a',$$

but the distances of the two curves from each other at each point will then be

$$1\,(a'-a),\ 4\,(a'-a),\ 9\,(a'-a),\ 16\,(a'-a),\ \ldots\ n^2\,(a'-a),$$

Q. E. D.

Extending this theorem to the circle, to the extent that it resembles the parabola, we obtain the following formula, which is one of fundamental importance for the conduct of quick and skilful field-work, and of which we shall make many important applications. It should, therefore, be indelibly engraven on the memory.

ANY NUMBER OF CIRCULAR ARCS OF DIFFERENT RADII, HAVING A COMMON TANGENT POINT, DEFLECT FROM THEIR COMMON TANGENT AND FROM EACH OTHER SUBSTANTIALLY IN ACCORDANCE WITH THE LAW OF THE PARABOLA, OR AS THE SQUARE OF THE DISTANCE FROM THE $P.\ C.$, AND THEIR DEFLECTION AT ANY POINT IS GIVEN BY THE FORMULA

$$O = \frac{7}{8}\, n^2\, D,$$

in which O = the offset or deflection.
n = the distance in stations from the P. C.
D = the degree of curve (in cases of deflections from a tangent) or the difference in degrees of curvature, in cases of deflections of one curve from another.

Demonstration: Let C E, Fig. 26, be the required offset O, to a point E distant n stations from the $P.C.$, P. The chord for an angle of 1° for a radius of 1 station = 1.7453 ft.; for an angle of 10', 17.431 ft, or 1.7431 per degree; and for an angle of 20', 34.73 ft. or 1.7365 per degree. By taking an even value of 1.75 ft. per degree, we shall be sufficiently exact for small arcs; and even for larger arcs, up to 20° or even 30°, the formula will meet the practical requirements of such cases, the exact value for 30° being 51.764 or 1.7255 per degree.

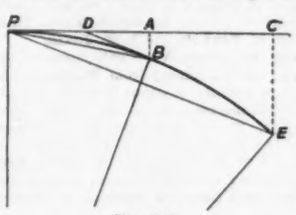


Fig. 26.

The angle of deflection, C P E, Fig. 26, for n stations $= \frac{1}{2}\, n\, D$ ($\S$——). The chord of 1° for a radius of n station $= 1.75\ n$.

Then we have:

$$O = \left\{\begin{array}{l}\text{angle of deflection for } n \text{ stations} \times \text{chord of} \\ \text{1° for } n \text{ stations.}\end{array}\right.$$
$$= \tfrac{1}{2}\, n\, D \times 1.75\, n$$
$$= \tfrac{7}{8}\, [log\ 9.94052^1]\ n^2\ D\ nearly \qquad (\ )$$

If the offset O be measured at right angles to the tangent, and hence to a point on the curve somewhat more than n station from the $P.C.$ (by as much as a long chord n stations long falls beyond the successive short chords for n stations) this formula always gives the offset somewhat too small. If the offset be measured from a point n stations from the $P.\ C.$ on the tangent to a similar point n stations from the $P.\ C.$ on the curve, the offset will be more nearly exact but slightly too large.

However measured, the error is less than 0.05 for all ordinary arcs 200 to 400 ft. long, or for arcs of 1° curves (or of curves differing by 1° in their degree, $\S$——) 1,000 ft. in length. Offsets for larger arcs than this we shall find to be required chiefly in order that it may be approximately determined where a curve will fall on the ground before running it, and for all such purposes the formula is sufficiently exact for any curve and any distance.

The applicability of this formula to the deflection of curves from each other follows from preceding demonstrations ($\S\S$ . . . .) but may be independently demonstrated as follows:

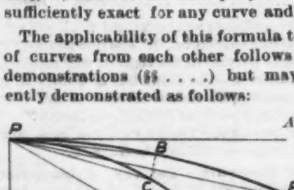


Fig. 27.

Let B, Fig. 27, be any station on any $D°$ curve distant n stations from the $P.\ C.$, and C be a corresponding station n stations from the $P.\ C.$ on any sharper $D'°$ curve, the two curves having a common tangent point at P.

Then the angle $BPC = APC - APB = \frac{n\,D'}{2} - \frac{n\,D}{2}$

$$= n\,\frac{D-D'}{2}$$

The length of the long chord P C increases as n *nearly*. Hence we have for the distance B $C = O$, remembering that the chord of 1° for a radius 100 = 1.75 *nearly*.

$$O = 1.75\ n \times n\,\frac{D-D'}{2}, \quad \text{whence}$$

$$O = \tfrac{7}{8}\, n^2\, (D - D') \qquad (\ )$$

[log. 0.87 (or more exactly 0.872) 9.94052]

The following examples will show both the simplicity and the range of accurate use of this almost indispensable approximate formula.

1. Deflection of a 2° 30' from a 1° curve in 12 stations. We have

$O = \frac{7}{8} \times 12^2 \times 1.5 = 189.0$ ft., or by logarithms (Table 19)

Log 1° 40'	0.17609
" $\frac{7}{8}$ (i. e. .872)	9.94052
" 12^2	2.15836
$O = 188.35$	2.27497

The true value, determined from the long chords and difference of deflection angle, is 187.41 ft., an error of 0.94 ft.[2] It rarely happens that such extreme distances are required. For half the distance the error almost vanishes, as the following example will show.

2. Deflection of a 2° 30' from a 1° curve in 6 stations. We have $O = \frac{7}{8} \times 6^2 \times 1.5 = 47.25$ ft. By logarithms, using the more exact value of the factor $\frac{7}{8}$ (that is 0.872), we obtain 47.08 ft. True value, 47.07 ft.

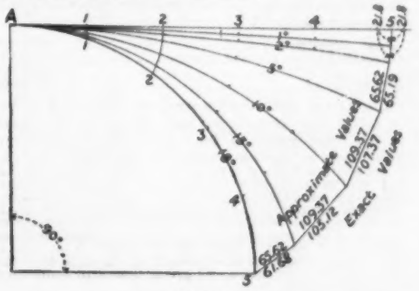


Fig. 28.

3. The cases shown in Fig. 28, viz., the successive offsets from a tangent to a 1°, 2°, 5°, 10°, 15° and 18° curve, for distances of 2 and 5 stations (the more extreme cases, where the error becomes noticeable, being entirely beyond the usual requirements of practice, but being given to illustrate the nature and extent of the error resulting from the use of the formula under varying conditions):

For a distance $n = 2$.

Case	1	2	3	4	5	6
Offset from	tangt. to 1°	1° to 2°	2° to 5°	5° to 10°	10° to 15°	15° to 18°
By approx. formula, $O = \frac{7}{8}\, n^2\, D$	3.50	3.50	10.50	17.50	17.50	10.50
True distance.	3.49	3.49	10.47	17.38	17.20	10.30
Error.	+0.01	+0.01	+0.03	+0.12	+0.24	+0.20

For distance $n = 5$.

Case	7	8	9	10	11	12
By approx. formula.	21.87	21.87	65.62	109.37	109.37	65.62
True distance.	21.81	21.81	65.19	107.37	105.12	61.68
Error.	+0.06	+0.06	+0.43	+2.00	+4.25	+3.94

The error is in practice even less than would appear from these examples when using the formula for its main purpose, determining in advance the effect of given changes of line, or the change to produce a given effect. Thus the true distance between points 200 ft. *in an air line* from the $P.\ C.$ on a tangent and a 15° curve respectively is by formula 52.5 ft., actually 52.80 ft., an error of 0.3 ft. in deficiency instead of the above errors in excess.

4. Given a 4° curve 800 ft. long, to change the degree of the curve to throw it in 55 ft. Letting D = the required change, we have:

$$55 = \frac{7}{8} \times 8^2\, D \text{ whence } D = \frac{55}{56} = 59' \text{ nearly, or say } 1_{00}.$$

Error. If D be called 1°, the curve will be thrown over 55.83 ft. If D be called 0° 59', giving a 4°59' curve, the curve will be thrown over 54.60 ft.[2]

5. Required, the point at which to compound a 7° 20' into a 9° curve in order to throw the curve in 22 ft. We have $22 = \frac{7}{8}\, n^2 \times (1° 40')$

whence $n = \sqrt{\frac{22}{\frac{7}{8} \times (1° 40')}}$

log 22	1.34242
colog 1° 40' (Table 19)	9.77799
" $\frac{7}{8}$ (i. e. 0.872, from Table 19)	0.05948
	21.17989
$n = 3.89$	*log* 0.59994

Error. The curve, when rerun by these notes, will actually be thrown in 21.68 ft.

RAPID TRANSIT IN BALTIMORE is the purpose of an ordinance now before the councils of that city. The Baltimore Belt Railroad Co asks for a franchise to build a tunnel under the city, to connect with some of the principal railroads, and give the people

[1] This log is for the more exact value, 0.872.

[2] This example is from Searle's "Field Engineering," where, by a very complex method, needless to detail, the distance is found to be 187.65 ft., an error of 0.24 ft.

[2] This example also is from Searle's "Field Engineering," the same result being obtained by very complex formulas.

greatly increased facilities for the transaction of business. The Baltimore & Ohio Railroad and the Maryland Central Railroad will be chiefly benefited, and the latter will be widened to a broad-gauge and double-tracked to York, Pa. The project is endorsed by prominent engineers and citizens and is being treated by the press as a scheme likely to greatly benefit the city. Mr. WM. GILMORE, is president of the new company, and Mr. JOHN B. MCDONALD, a well known railroad contractor and member of the firm of Ryan & McDonald, has been very active in the enterprise and will be doubtless one of its directors. The estimated cost is between $5,000,000 and $6,000,000. The natural conformation of Baltimore should certainly make such a tunnel a paying enterprise; and in the light of modern appliances for street tunnelling, such as have been successfully used in London and elsewhere, the execution can present no unsurmountable engineering difficulties.

RAILWAYS.

EAST OF CHICAGO.—Existing Roads.

Old Colony.—The annual report of this company for the year ending Sept. 30, 1889, shows the following results from operations:

Gross earnings	$7,726,311
Operating expenses and taxes	5,731,276
Net earnings	$1,995,035

During the year the branch from Wrentham to Walpole, has been commenced and will be completed early in the next year. In their report the directors say: There are several important branches needed to bring together in a more compact form the different parts of the Old Colony system of railroads. The Milton Branch should be extended to join the Providence Railroad; a junction should be made between the West Roxbury Branch and the Northern Division at or near Sherburn, and the Wrentham Branch be extended to meet the Providence R. R. near the State line. It is not the purpose of the directors to urge the building of all these branches at once, but they ask to be given power to build them if deemed expedient.

New York, New Haven & Hartford.—The annual statement of this company for the last fiscal years shows the following results from operations:

Total income	$10,313,353
Total expenses, including rents, taxes, and interest	8,680,284
Net earnings	$ 1,633,069

The report says: The four tracks on the line between New Rochelle and Port Chester have been completed during the past year. As foreshadowed in the last annual report, a double track upon the Shore Line divisionhas become a necessity, and work has been begun and is now being actively prosecuted at various points on the 27 miles between Clinton and New London. Upon the New York division the work of four-tracking will be resumed. A section begun at Westport, where the stone ballast now ends, and running west to South Norwalk, will be put under contract at once.

Central Vermont.—This company has completed surveys for a line from Windsor to Bellows Falls., Vt.

New York, Ontario & Western.—About 60 men with locomotives and steam-shovels are at work on the approaches for the zigzag tunnel near Utica, N. Y. It is stated that a greater part of the tunnel proper, will be through solid rock.

Cornwallis Valley.—A press dispatch states that this company intends next spring to build a dyke from Kingsport, N. S. to Long Island, shutting out the west end of the Basin of Minas, and reclaiming about 10,000 acres of land. The cost of the dyke is estimated at $750,000.

Grand Trunk.—It is stated that this company is negotiating for the purchase of the Brockville, Westport & Sault Ste. Marie R. R., with the object of extending it to the Sault Ste. Marie.

Lehigh Valley.—About 80 per cent. of the right of way for the line from Buffalo to Geneva, N. Y., has been secured. The length of the road will be about 104 miles.

Canadian Pacific.—This company has under consideration the construction of an inland basin with elevators and store houses at Montreal, P. Q. The cost of the work will be about $6,000,000.

Keeseville, Ausable Chasm & Lake Champlain.—A press dispatch from Plattsburg, N. Y., states that tracklaying on this New York road has been completed from Keeseville to Ausable Chasm. Grading is in progress on the remainder of the line to Port Kent, N. Y. Work is also in progress on the masonry for the bridge across the chasm.

Erie & Huron.—This company asks authority to construct a railway from its line at Dresden, Ont., via Oil Springs to Petrolia, Ont., also a line from a point on the main line between Oil Springs and Dresden to the Grand Trunk Ry., near Thamesville.

Philadelphia & Reading.—Chief Engineer NICHOLS, has completed the survey for the tunnel under Broad Mountain, in Schuylkill County, Pa. The east end will be at a point near Minersville, and the west end at Gordon. The length will be 4 miles.——This company will build a branch from Williamsport to Muncy, Pa.

Projects and Surveys.

Ticonderoga.—Organized in New York to build a railway from Ticonderoga, N. Y., to the main line of the Delaware & Hudson Canal Co.'s R. R., at Addison Junction, a distance of about 2 miles.

Baltimore Belt.—It is stated that arrangements are nearly completed for the commencement of work upon this road. The drawings, plans, specifications, and estimates for the tunnel under Howard Street and the various terminal facilities have been made. The total cost of the work will be about $5,000,000.

Newark & Passaic.—Incorporated in New Jersey to build a railway from the east side of Avenue E, between Emmet and Wright Streets, in Newark, to a point on the right bank of the Passaic River, a distance of 3 1-10 miles. Among the incorporators are: JOHN HOOD, of Camden, N. J.; ABRAM L. VOORHIS, of Newark, N. J.; and FRANK W. COWARD, of Perth Amboy, N. J.

Aylmer & Port Burwell.—At a meeting of the stockholders, recently held, it was decided to make immediate application to the Ontario Legislature for a charter to build a railway from Port Burwell, via Vienna and Aylmer, to a point in North Dorchester or North Oxford.

East Chicago & Lake Michigan.—This company has been incorporated in Indiana to build a railway 7 miles long in Lake County. Among the directors are: THOS. W. JOHNSON, JOS. W. TAYLOR, and L. M. JONES.

Wilkesbarre & Williamsport.—This company has been organized to build a railway from Wilkesbarre to Williamsport, Pa., a distance of about 75 miles. The object of the road is to furnish a short line to New York from Williamsport. The directors are: A. P. RYMAN, H. A. FULLER, IRA HARTWELL, F. C. STURGESS, A. S. ORR, E. TROXELL, F. W. WHEATON, and GEORGE R. BEDFORD, of Wilkesbarre; GEORGE NESBITT, of Kingston, and J. W. OGDEN, and GUSTAVE KISSELL, of Morristown, N. J.

Vincennes, Oakland City & Owensboro.—A press dispatch from Louisville, Ky., says: "Col. JOSHUA D. POWERS and Mr. STEPHEN POWERS, of Owensboro, and Col. J. C. FAWCETT, of this city, have just organized a new contract company, which, there is every reason to believe, is to construct the Vincennes, Oakland City & Owensboro railway. The gentlemen have gone very quietly to work on their plans, and will say very little about them, but the projectors have announced that the road would be commenced in a short time, and it is generally accepted that the work is to be done by the new company. The name of the organization is the Kentucky & Indiana Contract Company, and the principal place of business will be in this city."

Lindsay, Bobcaygeon & Pontypool.—This company has been chartered to build a railway from Pontypool. Ont., via Lindsay, to Bobcaygeon, Ont.

Trenton Cut Off.—Chartered in Pennsylvania to build a railway from a point in Southampton Township, Bucks County, to Morrisville, Pa., a distance of 16 miles. Among the incorporators are: J. N. DUBARRY, HENRY D. WELSH, of Philadelphia, WM. A. PATTON, of Radnor, Pa., and N. P. SHORTRIDGE, of Wynnewood, Pa.

SOUTHERN.—Existing Roads.

Middlesborough Belt.—The contract for building this Tennessee road has been let to Allison, Shafer & Co., of Chattanooga, Tenn. The line has been located and construction will commence Dec. 1. M. F. NEUER is Chief Engineer.

Norfolk & Western.—The statement of this road for the first 10 months of 1889 shows the following results of operations as compared with the same period in 1888:

	1889.	1888.
Gross earnings	$4,564,351	$4,062,175
Operating expenses and taxes	2,846,049	2,462,571
Net earnings	1,718,302	1,599,604

It is stated that contracts will be let and work will soon commence on the line to Ironton, O. The line has been located and a greater portion of the right of way secured.

Columbus Southern.—The Columbus & Quincy R. R. Co., has been incorporated in the interest of this company to continue the road from Albany, Ga., south.

Lynchburg & Durham.—Tracklaying has been completed to within 3 miles of Halifax, C. H., N. C.

Louisville & Nashville.—The city of Clarksville, Tenn., has subscribed $50,000 in aid of the line from Clarksville to Dickson, Tenn.

Georgia Pacific.—Inducements are being offered to this company to build a branch from a point on the main line between the Bogue and Sunflower Rivers south through Boguephalia and the Murphy's Bayou country, a distance of about 30 miles.

Mobile & Ohio.—Surveys have been completed for a branch from Okolona to Houston, Miss., a distance of 20 miles.——It is stated that surveys will soon commence for a branch from a point on the main line between Corinth and Baldwin, Miss., to Birmingham, Ala.

Knoxville Southern.—Good progress is being made on the construction work of this road. The line is now graded from Knoxville south to Madisonville, Tenn., and north from Blue Ridge, Ga., to the Hiawassee River. All but 28 miles of the grading has been completed and work is in progress on this section. The company will build a bridge across the Tennessee River at Knoxville, and contracts will be let next spring.

Projects and Surveys.

Georgia.—The following bills were introduced in the Georgia State Legislature during the last session: To incorporate the Union R. R. & Transfer Co., the Midville, Swainsboro & Red Bluff, the Eatonton & Madison, the Macon, La Grange & Birmingham, the Georgia & Tennessee, the Rome, Subligna & Northern, the Union Point & Elberton Short Line, the Atlanta & Alabama Coal & Iron, the Fairmount Valley, the Kansas City, Chattanooga & Port Royal, the Richmond County Belt Line, the Melon Belt, the Albany, Florida & Northern, the Valdosta & Ocean Pond, the Simmons Short Line, the Florida, Dawson & Northern, the Americus & Jacksonville, the Covington & Cedar Shoals, the Dublin & Blackshear, the Savannah & Isle of Hope, the Hawkinsville & Florida Southern, the Way Cross Air Line, the Bainbridge & Northeastern, the Chattanooga & Gulf, the Bainbridge, Lake Douglas & Suburban, the Abbeville & Way Cross, the Turtle River, the Woodsville, Renfield & Oconee Valley, the Artesian City, the Smithsonia & Carnesville, the Lincolnton & Augusta, the Albany & Cordele, the Ocean Pond & St. Marys Short Line, the Dahlonega & Dawsonville, the Atlanta & Lithonia, the South Bound, the Bainbridge, Cuthbert & Western, the Collins Park & Belt, the Atlanta & Seaboard, the Thomasville & Suburban, the Augusta & Western, the Calhoun & Fairmount, the Dalton & Stephenson, the Belton, Homer & Carnesville, and the Washington & Lincolnton Railway Companies.

Southern Railway Construction Co.—This company has been chartered in Kentucky to build lines of railway in that State. The incorporators are: WM. AYRES, JAS. G. GIVENS, and HARRY STUCKY. The principal office wil be at Louisville, Ky.

Chattanooga, Gadsden & Birmingham.—Surveys it is stated, will soon commence for this line which is projected to run from Menloe, Ga., via Gadsden, Ala., to Birmingham, Ala.

Buckhannon & Holly River.—This company has been chartered in West Virginia to build a railway from Philippi, W. Va., via Buckhannon, to Webster Court House, thence the line will run to Braxton Court House, where connection will be made with the new line now being built from Weston to Braxton Court House, and from Braxton Court House the road will run along the valley of the Elk River to Charleston, W. C. The road is to be a link in the through line from Pittsburg, Pa., to Charleston, W. Va., and the south. Among the incorporators are: W. J COWDEN, of Wheeling, W. Va., T. S. CHRISTY, of Pittsburg, Pa., and M. S. QUAY, of Beaver, W. Va.

NORTHWEST.—Existing Roads.

Sioux City & Northern.—A press report states that tracklaying has been completed on this road to Doon Ia., 40 miles from Garrison. The grading of the Merrill branch has been completed for a greater portion of the distance.

Port Arthur, Duluth & Western.—This company has filed an application to construct a branch from the main line to the Kakabakka Falls, on the Kamminestiqua River, in Ontario.

Canadian Pacific.—About 130 miles of the Qu'Appelle, Long Lake & Saskatchewan R. R. has been graded. Work has been stopped for the winter.

Projects and Surveys.

Belleville & East St. Louis.—Incorporated in Illinois to build a railway from Belleville to East St. Louis, Ill., about 8 miles. The capital stock is $500,000, and the principal office is at Belleville. The incorporators and first Board of Directors are: Dr. JULIUS KOHL, H. G. WEBBER, JOS. FUSS, and CHARLES KRISPEL, of Belleville; HENRY SETTER and J. D. BAKER, of Lebanon; J. L. WIGGINS and HENRY D. SEXTON, of East St. Louis.

Belleville Terminal.—Chartered in Illinois to build a belt line of railway around the city of Belleville. The incorporators are the same as for the Belleville & East St. Louis R. R.

SOUTHWEST.—Existing Roads.

Williamsport & North Branch.—This company has purchased the right of way for its proposed extension from Halls to Williamsport, Pa. The line has already been located.

Fort Worth & Rio Grande.—The contract for grading 16½ miles of this road from Comanche County line to the west line of the town of Comanche, has been let to Martin, Byrne & Johnson, of Colorado, Tex. There will be about 220,000 cu. yds. of earth excavation and embankment and 100 acres of clearing and grubbing. The contract price was $28,000. Work is to begin as soon as the line has been cross-sectioned.

Austin & Northwestern.—It is stated that this company will at once extend its line from Burnet to Llano, Tex.

St. Louis & San Francisco.—It is stated that the Kansas Midland R. R. Co. is considering extending its

road from Wichita, via Valley Center, Sedgewick, and Halstead to McPherson, Kan., a distance of about 60 miles.

Missouri Pacific.—It is announced that this company has closed a contract to build 100 miles of railway from Deermott, Ark,. to Monroe, La. Work will begin at once.

Dallas, Pacific & Southeastern.—This company has completed about 75 miles of grading.

New Orleans, Natchez & Fort Scott.—A dispatch from Little Rock, Ark., states that this company now has a large gang of men at work grading across the Mississippi bottom to Cicily Island. Work is also in progress in the bluffs on both banks of the river near Natchez, Miss. About 18 miles of grading has been completed in the Concordia Lake neighborhood.

Denison & Washita Valley.—Arrangements are reported completed for the early construction of this road from Kasonia to Denison, Tex. Surveys will commence at once,

Projects and Surveys.

Hammond & Baton Rouge,—A company is being organized to build a railway from Hammond on the Illinois Central R. R. west to Baton Rouge, La., a distance of about 45 miles.

Kansas City & St. Louis.—A press dispatch from Kansas City, Mo., says that certain capitalists are seriously considering the building of a double track road between Kansas City and St. Louis, solely for the purpose of carrying freight at the lowest paying rates.

St. Joseph & Southeastern.—This company was chartered several years ago to build a railway from St. Joseph to Smithville, Mo., with the intention of extending the road to Kansas City ultimately. No way being found to enter Kansas City the project was dropped. The Winner Bridge now affords an opportunity for getting into the city, and it is stated that the company will be reorganized. The distance from St. Joseph to Smithville, is about 57 miles. From Smithville to Kansas City the tracks of the Chicago, Kansas City & Texas R. R. would be used.

ROCKY MT. AND PACIFIC. Existing Roads.

Seattle, Lake Shore & Eastern.—This company has advertised for bids for grading, clearing, grubbing, and trestling in sections of 5 or 10 miles length, of 40 miles of the northern branch.

Chicago, Burlington & Quincy.—The Burlington & Missouri River, R. R., it is stated, will extend its line from Newcastle, Wyo., to a connection with the Northern Pacific R. R. Work will begin early next spring.

Union Pacific.—A press dispatch from Boston states that the negotiations between President ADAMS, of the Union Pacific, and the Denver, Texas & Fort Worth people have resulted in agreements, yet to be drawn and ratified, for the formation of a corporation to be known as the Union Pacific, Denver & Gulf Railway, which will absorb the Fort Worth Road and the Colorado lines of the Union Pacific, except the old South Park Road, now known as the Denver, Leadville & Gunnison. The basis of the new company will be on the same lines as those of the Oregon Short Line Consolidated Company. The new company will operate about 1,400 miles from Cheyenne and Denver to the Gulf of Mexico.—It is stated that Kilpatrick & Collins, Omaha, Neb., have the contract for grading of the first 200 miles of the extension to Los Angeles, Cal.

St. Paul, Minneapolis & Manitoba.—Tracklaying has been commenced on the extension of the Sand Coulee branch of the Montana Central R. R. to the Belt Mountains.

Tacoma & Puyallup.—About 60 men are at work on this road, which is projected to run from Tacoma to Puyallup, Wash,. 13 miles. It is expected that the line will be completed by March 1.

Denver & Rio Grande.—A meeting of the stockholders of this company will be held Dec. 31 to consider a lease by the Denver & Rio Grande Railroad Company to the Colorado Midland Railway Company of an undivided moiety of the line between New Castle and Rifle Creek, Col., and also a contract between the Denver & Rio Grande Railroad Company and the Midland Railway Company, as parties of the first part, and the Rio Grande Junction Railway Company, for the leasing of the line of the latter company, when completed, and also a lease by the Denver & Rio Grande Railroad Company to the Rio Grande Western Railway Company of the line between Grand Junction and Crevasse, Col., and for the purpose of determining whether such leases and contract for lease shall or shall not be assented to and perfected. The contract for building the Tennessee Pass tunnel has been let. It is about 2,500 ft. long, located near Leadville, Col. The work is to be completed in six months.

Astoria & South Coast.—Considerable progess is being made in the construction work of this Oregon road. About 600 men are now at work on the line. The company expects to have 5 miles of track on the Hillsboro end and 10 miles at Junction completed by Jan. 1, 1890.

Silverton.—OTTO MEARS, President, is quoted as saying that this company would build a rack railway from Ironton to Ouray, Col., during the coming season.

Projects and Surveys.

Columbia River.—This company will apply for a charter to build a railway from a point on the Columbia River, about 17 miles east of Golden, B. C., to the headwaters of the Spiliamacheene River.

Columbia & Kootenai.—Surveys will soon commence for this road which is projected to run from Sprout's Landing to Nelson, B. C. It is stated that construction will begin as soon as the survey is completed. D. A. STEWART, is the engineer in charge of the surveys.

Portland & Astoria.—Surveys are reported in progress for a railway to run from Portland to Astoria, Ore. JOHN HULBERT is the engineer in charge of the surveys.

Denver, Colorado Canon & Pacific.—The surveys for this road have been resumed under the direction of Chief Engineer, ROBERT B. STANTON. The length of the line from Grand Junction, Colo., to the coast will be about 1,100 miles, and of this distance about 400 miles has been surveyed.

FOREIGN.

Peru.—The following concessions have been granted by the Peruvian Congress: A concession to build a line of railway from the terminus of the Oroya Railway or any of its branches to a point on any navigable tributary of the Amazon River, with the right of free navigation thereof, and the concession of 6,000 hectares of land for each kilometer of road built; a concession to build a railway from Puno to Desaguaders, to connect with the new Bolivian system; and a concession to bondholders of 2,000,000 hectares of land.

Mexican Pacific.—Charles Thornton has secured the contract for building this road from La Puerto to Frontiera, a distance of 350 miles.

Siberia.—M. ANTOINE ZDZIARSKI, of St. Petersburg, Russia, an engineer in the Russian Department of Railways, is now making a study of the railway system of this country preparatory to a report on the best system to follow in the construction of a railway across Siberia. He states that the route has not yet been fully determined upon, but it will probably begin at Zintoust, in the Ural Mountains, the present terminus of the road from Samara. Thence it will run to Omsk; from there to Irkutsk on Lake Baikal, which it is proposed to cross by ferry. Thence the road will run to Srientensk on the Amoor River. From here steamers will run to Boosa, from which place the road will run to Uladivostock, on the Sea of Japan. The work will be difficult through the Ural Mountains and from the Amoor River east through the Stanovyi and Bureya Mountains.

Mexico.—The Mexican Government has granted charters to Señor FELICIANO SAN ROMAN to build lines of railway from Matamoras along the coast to Tuxpan; from Tuxpan to connect with the Mexican National R. R. at Tehuantepec, and thence to either Campeche or Tabusco, in Yucatan; from a point on the last line to Guatemala, and from Tuxpan to the city of Mexico.

Monterey & Mexican Gulf.—Construction on the line to Tampico, on the Gulf of Mexico is being rapidly pushed. Four hundred flat, box and stock cars are expected to arrive this week, and within two weeks steel rails to the amount of 1,000 tons a week will arrive until the line is completed to the Gulf. Bridge timber will come through in proportion, including 500,000 ties. The branch of the line running from Monterey west to Chihuahua is being built, and a connection will be there made with the Mexican Central. On this line the town of Venadito is the present temporary stopping place. As soon as the line is run through to Tampico, a survey will be made to the City of Mexico, and there is a strong probability that a third rail will be laid on the Mexican National track from Monterey to Laredo, Tex., thus giving the Monterey and Gulf an outlet to the United States. Twelve new locomotives from Paterson, N. J., are expected to arrive at once. The line is now completed 135 kilos., and will reach Linares in two weeks. Passenger and freight depots and headquarters are now being erected in Monterey.

San Domingo Central.—At a meeting of the stockholders recently held at 32 Liberty St., New York City, the following directors were elected: H. C. KING, H. L. BEAM, B. P. HARRIS, G. G. WARD, MILTON GRISWOLD, W. H. BIBBY, C. C. MONROE, J. E. COLEMAN, and H. W. ALDEN. The construction of the road has just begun, although the concession was granted by the San Domingo Government some time ago. The line will run from the southern coast of the island to a salt mountain, in which is an almost inexhaustible supply of salt of a fine quality.

Uruguay.—A concession has been granted by the Government of Uruguay to a company of London capitalists to build 600 miles of railway from Montevideo to Rosario and Paysandu.

Yucatan.—In this Mexican State one of the existing lines, between Progreso and Merida, is to be extended from Tekanto to Izamal, and also from Tizcocoub to Sotuta and thence to Chan Santa Cruz. This will add 200 miles to the railways of Yucatan.

RAPID TRANSIT.

Electric Railways.—***Atlanta, Ga.***—An electric line to Savannah is projected. The plant is to be driven by the water power of the Ocmulgee and other rivers along the route.

Cincinnati, O.—The Cincinnati St. Ry. Co. has awarded to Wm. Kirkup & Son the contract for the steel poles for the extension of the Colerain Ave. electric road.

St. Louis, Mo.—The Central & Western Ry. Co., which is a reorganization of the St. Louis Cable & Western Ry. Co., proposes to operate the Narrow Gauge Ry. by an overhead electric system.

Kansas City, Mo.—The Suburban Electric Ry. Co. is making arrangements to build its electric road on Troost Ave.

Astoria, Ore.—A company has been organized to build an electric railway 10 miles long, at a cost of $100,000.

Seattle, Wash.—The West Seattle & North End Electric St. Ry. Co. has been incorporated to build a line 12 miles long. Dr. GILMAN is President and will purchase material at once. The road is to be in operation to the suburban town of Ballard by May, 1890. Capital stock, $1,000,000.

North Yakima, Wash.—An electric railway is projected.

Milford, N. H.—Surveys have been made for an electric road to Amherst.

New Orleans, La.—The New Orleans & Carrollton Ry Co. has applied for power to adopt the Sprague electric system.

Dummy Lines.—***Yaquina City, Ore.***—A dummy line is to be built to South Beach.

Olathe, Kan.—A dummy line is proposed to be built to Rosedale, to connect with the Metropolitan line for a through route to Kansas City. The South Park Association is interested.

Portland, Me.—A dummy line is to be built on Long Island, in the harbor. HENRY CUSHING, Capt. MCVANE, and MRS. ANDREWS are interested.

Cable Railways.—***Sioux City, Ia.***—The cable railway company has been granted a franchise covering Jackson St. north from 14th St.

Oakland, Cal.—The Twelfth St. Cable Ry. Co. has been incorporated by M. H. CROSSMEYER, WALTER F. BECK and others. Capital stock, $1,000,000.

Street Railways.—***Rome, Ga.***—Subscriptions are being raised for a new line through South Rome. Mr. N. H. BASS is interested.

Punta Gorda, Fla.—A street railway is projected and information desired as to the cost of construction and operation of a horse or electric road. For particulars address NEIL DAHL.

Detroit, Mich.—A street railway 2 miles long is to be built on McClellan Ave., from Detroit Ave, to Jefferson Ave.

Jefferson, Ia.—A street railway is projected.

Garden City, Kan.—Another street railway line is projected.

Uvalde, Tex.—A street railway company has been organized, and all the stock subscribed for. Contracts for material will be let and work commenced at once.

Toronto, Ont.—The city has notified the Toronto Street Ry. Co. that it will assume the ownership of the lines on the expiration of the company's charter.

HIGHWAYS.

Denver, Col.—The City Engineer has completed plans for a new road 60 ft. wide along the west bank of Cherry Creek, from Broadway to Colfax Ave.

Cumberland, R. I.—The work of macadamizing the roads in the northern portion of the town is nearly completed, that is, as much work has been done as is intended, and the roads in the southern section of the town are soon to be repaired. As the time has arrived when the matter of sewerage becomes of great importance, it is advisable to build the sewers before this work on the road is done.

Minneapolis, Minn.—Engineer FRANK H. NUTTER has completed the survey of the proposed Minnehaha boulevard from Lake Harriet to Minnehaha Falls. The land donated varies from 200 ft. in width to 600. It is hoped to get the matter of right of way disposed of this winter, so that work on the roadway may begin early in the spring.

CONTRACTING.

Levees.—The contract for constructing the Pecan Grove levee in East Carroll Parish has been awarded by the Levee Commissioners at Baton Rouge, La., to P. J. Trezevant for 18 cts. per cu. yd.

Materials for the Navy.—Contracts for furnishing material to be used in constructing the machinery of cruisers Nos. 7 and 8 have been made as follows: Watson & Pettinger, of Brooklyn, pattern makers, lumber, $2,006; Bethlehem Iron Co., South Bethlehem, Pa., finished steel shafts, 31 cts. per lb. (about $70,000); Continental Iron Works, Brooklyn, corrugated furnaces, $36,080; D. B. Cobb, of Brooklyn, condenser tube sheets and packing, $4,900; J. J. Donovan, of New York, anti-friction metal, $900; Rowland O. Robbins, of New York, pig tin, $2,300; Midvale Steel Co., Philadelphia, piston rods, connecting rods, etc., $85,577; Oliver Iron & Steel Co., Pittsburg, rivets, $5,040.

Excavation and Filling.—The Allison & Shafer Construction Co., of Chattanooga, Tenn,, which has the con-

tract to change the course of the Big Yellow Creek at Middlesborough, Ky., has received the contract to remove 500,000 cu. yds. of dirt from two of the hills, to be used in filling up some portions of the old channels of that creek.

Hoisting Plant.—The following bids have been received by the Aqueduct Commissioners, New York City, for combined stationary hoisting engines and appurtenances at Shaft No. 25, on Section 12: Charles Peterson, $11,250; Robert J. Gray, $12,725; Dixon Mfg. Co., $14,960. The contract was awarded to Charles Peterson.—The following proposals have been received by the Docks Department, New York, for one Lidgerwood style improved drum, double end hoisting engine, with boiler and fixtures: H. A. Rogers, $1,910; Alexander Pollock, $1,948.50; Lidgerwood Mfg. Co., $1,975. The contract was awarded to H. A. Rogers.

Buildings.—The County Commissioners, Olathe, Kan., have advertised for plans and specifications for the new jail. It is proposed to erect the jail just before building the new court-house, which the county intends to build next year. The jail will cost $12,000 and the court-house $40,000.——Montgomery County, Ia., is about to erect a $75,000 court-house. Nineteen different plans have been submitted by architects.——The County Commissioners will erect a new jail at Guntersville, Ala. The commissioners are, Judge T. A. STREET, Guntersville, Ala.; W. M. FOSTER, Esq., Warrenton, Ala; D. P. HORTON, Esq., Baitlett, Ala.; W. F. CHANDLER, Esq., Henrysville, Ala.

Piles.—At Baltimore, Md., the following proposals have been received for furnishing the piles necessary for reconstructing Light St. Bridge, as follows: Charles S. Beebe, 7 and 8 cts. per lin. ft., two lengths, pine piles; Allen McKay, 5¼ cts. for pine, 14½ cts. for oak; Eugene Blake, 5½ and 14½ cts.; J. S. Hoskins, 6½ and 15 cts.; Ross & Sanford, 5½ and 8 cts. for pine and 13½ cts. for oak. The work will require 600 pine and 188 oak piles.

Cement.—The following proposals have been received by the Docks Department, New York: For 1,000 bbls. of Portland cement; Haebler & Co., $2.21½ per bbl.; James Brand, $2.35; Baetjer & Mayerstein, $2.38; Sinclair & Babison, $2.49; Charles H. Spencer, $2.50; E. W. Fisher, $2.50.—For 500 bbls. of Portland cement: James Brand, $2.35 per bbl.; Baetjer & Mayerstein, $2.35; E. W. Fisher, $2.35; Sinclair & Babson, $2.55; Haebler & Co., $2.75. The contracts were let to Haebler & Co. and James Brand.

Sewer.—The following proposals have been received by JOHN J. MCLAUGHLIN, C. E., Brooklyn, N. Y., for the construction of a 15-in. pipe sewer at Rockaway Park: W. L. Holmes, 28 cts. per ft. for sewer, $31 per manhole; T. W. Van Houten, 45 cts., $32.50; J. J. Clarke, 50 cts. $31; Theodore Jenkins, 50 cts., $30; Thomas McCann, 75 cts., $50; Edward Gorman, $1.25, $26. The contract was awarded to W. L. Holmes. The prices are for labor only, all pipe, bricks and timber being furnished.

Paving.—The following proposals for paving on a crib bulkhead have been received by the Docks Department, New York: John Cox, $1.23; G. W. Plunkit & Smith, $1.75. The contract was awarded to John Cox.

PROPOSALS OPEN.

Dam.—Dam and other works for water power. THE CITY ENGINEER, Winnipeg, Manitoba.

Sewers, Street Work, Etc.—No. 1: 11,000 cu. yds. of earth and 30,000 cu. yds. of rock excavation, 70,000 cu. yds. of filling, 19,500 ft. of curbing, 65,000 sq. ft. of flagging, 13,000 ft. of bridge stone, 300 cu. yds. dry rubble masonry, 40,000 lbs. of vitrified drain-pipe, 200 ft. of fence. No. 2; 3,800 sq. yds. of new trap block pavement, No. 3; 1,125 ft. of 12-in. pipe sewer, 125 spurs, 14 manholes, 2 basins, 5 cu. yds. of concrete, 1,000 ft. of lumber. No. 4: 108 blue-stone platforms, 5 ft. by 5 ft. 4 ins. to 6 ft.; 8 blue-stone platforms 7 ft. by 5 ft. 4 ins. to 6 ft.; piers for support. No. 5; 700 cu. yds. rubble stone masonry, 430 cu. yds. of wall. THE COMMISSIONERS OF PUBLIC WORKS, 49, 51 Chambers St., New York City. Dec. 11.

Lumber.—For the reconstruction of the Light St. bridge. A. E. SMYRK, City Commissioner, Baltimore, Md. Dec. 11.

Pier Work.—Building a crib bulkhead from E. 138th St. to E. 140th St., Harlem River; 100,000 cu. yds. dredging; 987,000 cu. yds. of cribwork. THE DOCKS COMMISSIONERS, Pier A, North River, New York City. Dec. 11.

Sewers.—In Kingston Ave. J. P. ADAMS, Commissioner of City Works, Brooklyn, N. Y. Dec. 12.

Bridge.—Across Colorado river; stone or tubular piers. J. M. BRACKENRIDGE, County Commissioner, Austin, Tex. Dec. 16.

Bridges.—Iron bridge, 100 ft. long, 14 or 16 ft. wide; bridge 24 ft. long and 20 ft. wide. THE COUNTY COMMISSIONERS, Del Rio, Tex. Dec. 16.

Pumping Engines.—Three compound engines of 10,000,000 galls. daily capacity each, and one of 4,000,000 galls. daily capacity; the water to be delivered through 7,000 ft. of 48-in. force main; 43 ft. static head. JOHN P. ADAMS, Commissioner of City Works, Brooklyn, N. Y. Dec. 30.

Water Works.—Plans and specifications with the Water-Works Engineer, W. H. KEAREY, Chairman of the Water Committe, New Westminster, B. C. Jan. 15.

MANUFACTURING AND TECHNICAL.

Market Prices.—*Rails.*—New York and the East: $34 to $35 at mill; old rails, $24.50 to 25. Pittsburg; $35 for heavy sections. Chicago; $37 to $37.50; old iron rails, $26.25 to $26.50; old steel rails, $20 to $21.

Track Material.—New York; spikes, $2.20 to 2.30; angle bars, 2.10 to 2.20 cts.; track bolts with square nuts, 3 to 3.25 cts. Pittsburg; spikes, $2.15; splice bars, 2 cts.; track bolts, 3 cts. with square and 3.10 cts. with hexagon nuts. Chicago; splice bars, 2 to 2.1 cts. for iron and 2.25 cts. for steel; spikes, 2.25 to 2.30 cts.; track bolts, 2.90 to 3 cts. with square and 3.05 to 3.10 cts with hexagon nuts.

Car Wheels.—The Indianapolis Car & Mfg. Co. is manufacturing car wheels on a large scale, turning out from 140 to 160 more wheels daily. The company has recently secured several large orders for wheels from the Ohio & Mississippi, the Cincinnati, Hamilton & Dayton and the Lake Shore roads.

Car Heating.—The Martin Steam Heating Co. has a contract for applying its system to the passenger equipment of the St. Louis, Alton & Springfield.

The Pond Engineering Co. will furnish the Vancouver Electric Street Ry. Co., of Vancouver, B. C., with two 100 H. P. Armington & Sims engines, and the Electric Light Co., of Dixon, Ill., with one engine of the same power. The company is selling many small vertical boilers throughout the southwest, and will erect one in the car-house of the Peoples' Cable Ry. of St. Louis.

Cement.—The stockholders of the Catasauqua Cement Co., of Allentown, Pa., have voted to increase the capital stock to $100,000 and double the capacity of the works.

Mechanical Stoker.—The Roney stoker is to be put in at the water-works pumping station at Madison, Wis.

Signals.—The Henion Electric Signal Co. has been organized at Wilmington, Ill., by Wm. HENION, J. F. JOHNSON and F. R. MULLIN. Capital stock, $20,000.

Supplies.—The Central Railway Supply & Construction Co. has been incorporated at Indianapolis, Ind., to manufacture supplies for railways and street railways. Capital stock, $50,000. Directors, JOHN E. MCGETTIGAN, FRANK S. FOSTER, LEWIS P. HORTON, FRANK A. LAPHAM and EPHRAIM C. DAWES.

Electric Headlights.—The Edwards Electric Locomotive Headlight Co., of Richmond, Ind., has a contract to put these headlights on 10 Pennsylvania R. R. engines. J. W. CARPENTER, of Dayton, O., is President of the company.

Ties.—Crawford & Allen, of St. Louis, Mo., who have the contract for furnishing ties to the Gould railways, have purchased 1,600 acres of timber land in Arkansas for $6,242, and will commence developing at once, employing 200 hands in cutting ties.

Locomotives.—The Portland Co., of Portland, Me., is building a locomotive for the Windsor & Annapolis, and a snow plow for the Montpelier & Wells River.

H. K. Porter & Co., of Pittsburg, have built a switch engine for the Washington navy yard, and are building several motors for street railways at Elmira, N. Y., Anniston, Ala., Tacoma, Wash., and San Francisco, Cal.

The Baldwin Locomotive Works, of Philadelphia, have an order for an engine for the Kentucky & Indiana Bridge Co.

The King Locomotive Co., of New York, has leased the old shops formerly used by the Camden & Amboy Railroad at Bordentown, N. J., for a term of years for locomotive repair shops.

Cars.—The Terre Haute Car Co., of Terre Haute, Ind., has an order for 100 stock cars for the Cleveland, Cincinnati, Chicago & St. Louis.

The Gilbert Car Mfg. Co., of Troy, N. Y., has executed a mortgage to the Atlantic Trust Co., of New York in the sum of $100,000, covering all the works of the company on Green Island, and 94 lots or parcels of land in the village, insured for $237,000. It is said that the company borrowed the money for the purpose of extending the works.

The Michigan Car Works are building 300 freight cars for the Flint & Pere Marquette R. R.

The Missouri Car & Foundry Co. is turning out 25 finished freight cars a day. Included in new work upon which it is engaged are 200 stock and 200 box cars for the Panhandle.

The Pullman Car Co. has an order for 100 passenger cars and 1,000 freight cars for the Philadelphia & Reading.

The Roanoke Machine Works, of Roanoke, Va., has an order for 300 cars for the Erie and a large order from the Norfolk & Western.

The St. Charles Car Works, of St. Charles, Mo., have built 200 box cars for the St. Louis & San Francisco, and has an order for refrigerator, box, coal, and oil cars for the Louisville & Nashville.

The U. S. Rolling Stock Co. is building the following cars at its works at Hegewisch, Ill.: Passenger cars for the Monterey & Mexican Gulf and Hidalgo railways, of Mexico; 350 drop-bottom gondolas for the Pennsylvania Co.; fruit cars for the Georgia Southern & Florida; box, stock, and platform cars, hopper gondolas and cabooses, and one wrecking car for the Hidalgo road, and 30 cabooses for the Georgia Pacific. The Columbus, Hocking Valley & Toledo Railway will be in the market for 1,500 coal cars for summer delivery. The road is greatly in need of new equipment, and it is the intention of the management to supply the deficiency as soon as possible.

The Paige Tube Co., of Warren, O., was incorporated in June with a capital stock of $200,000, and in November the capital stock was increased to $500,000. The works were formerly known as the Warren Tube Co. Works, and have been repaired and enlarged under the Supervision of Superintendent T. J. BRAY, formerly superintendent of the Pittsburg Tube Co. and the Riverside Iron Works. The company will manufacture wrought-iron pipe, boiler tubes, hydraulic pipe, etc. President, O. C. BARBER; General Manager, A. T. PAIGE; Secretary, J. H. FAXON, Jr.

The Farrel Foundry & Machine Co., of Ansonia, Conn., had on exhibition at the American Institute Fair, in New York, of two rock and ore crushers in operation in the Machinery Hall. Over the machines in a frame, are about 100 medals awarded this machine in various expositions.

Brick and Pipe.—Two parties have started fire brick and sewer pipe works at Middlesborough, Ky. For particulars address the Middlesborough Town Co.

A company has been formed at Weston, W. Va., to establish a brick and tile factory with a capacity of 60,000 brick and 12,000 ft. of pipe per day. Mr. W. J. KITSON is the Manager.

BRIDGES AND CANALS.

Bridge Notes.—*Newton, Mass.*—The city has made an additional appropriation of $2,014 for the construction of the Bemis St. bridge.

Huron, N. Y.—A bridge is to be built across Sodus Bay at Port Glasgow, at a cost of $20,000. The legislature will be petitioned to appropriate $10,000, and Huron will raise the rest.

Rochester, N. Y.—The city will build a bridge over the river at Alexander St., and there will probably be an approach spanning the Erie R. R. tracks.——The Council has been petitioned to build a new arched stone bridge over the Genesee River at Court St, to replace the existing structure which is unsafe. Several other bridges are said to be unsafe.

Harrisburg, Pa.—The Philadelphia & Reading R. R. will bridge the Susquehanna near Rutherford, 4 miles east of Harrisburg, for its new extension.

Pittsburg, Pa.—Mr. JOHN P. WALKER, one of the incorporators of the company proposing to build a bridge over the Monongahela River at South 34th St., is reported as saying that the bridge will not be built for some time yet.

Ceredo, W. Va.—The West Virginia & Ironton R. R. Co. will build a bridge across the Ohio.

Columbia, Tenn.—The contract for the superstructure of the new iron bridge across the Duck River has been let to the Pittsburg Bridge Co., of Pittsburg, Pa., at $7,849. Holmes & Wilkes, of Nashville, have the contract for the substructure.

Greenville, S. C.—The contract for building the iron bridge across the Reedy River at Main St. has been awarded to the Southern Bridge Co., of Birmingham, Ala., at $7,475.

Macon, Ga.—Efforts are being made to organize the East Macon Improvement Co. to build an iron bridge across the Ocmulgee River at 2d St., at an estimated cost of $40,000.

Brooklyn, Ill.—The Paducah & Illinois Bridge Co., of Brooklyn, has been incorporated to construct a steel bridge across the Ohio River, at Brooklyn, for railway and other purposes. Capital stock, $100,000. Incorporators: CHARLES REED, SAM HOUSTON, W. W. PAXTON, and others.

Duluth, Minn.—The Terminal Co. will build a railway and highway bridge across the canal at Minnesota Point.

Minneapolis, Minn.—The Wrought Iron Bridge Co. has the contract for the new steel arch bridge, and it is proposed to remove the old suspension bridge and put it up at Minnehaha. A new iron bridge at the latter place would cost $35,000, and it is thought the removal and rebuilding of the suspension bridge might cost still more.

Sioux City, Ia.—A new bridge is wanted at 4th St., the present structure being too narrow and in bad condition.

St. Charles, Mo.—The City Council held a special meeting recently to consider a bid for the franchise for a term of years of constructing and maintaining a pontoon bridge over the Missouri River at this point. The promoters of the scheme want a guarantee of $5,000 from the business men, payable in sums of $1,000 per annum. This amount, it is believed, can be readily raised. If satisfactory arrangements can be made with the city, work will commence at once.

Glenwood Springs, Col.—The contract for the Rio Grande bridge has been awarded by State Engineer MAXWELL to the Bullen Bridge Co., of Trinidad, Col., at $37,489.

Montreal, Que.—The city has appropriated $30,000 for the Sherbourne St. bridge, and $14,000 for bridges over the tracks at Dundas St. and College Ave.

Bothwell, Ont.—County Engineer BELL of St. Thomas, has recommended that the County of Elgin, in conjunction with Kent and Middlesex, next year replace the present bridge at Bothwell with a stone and iron structure costing $23,000. The bridge is to consist of two spans of 125 ft. with one stone and one iron abutment, and a stone pier in the centre.

The Georgia Central Ry Co. will build iron bridges across Tobesofkee, Rocky and Tagror creeks.

Omaha, Neb.—The Iowa & Nebraska Ry. Co. proposes to bridge the Missouri River at Omaha. President, CARROLL WRIGHT, Des Moines, Ia.——The Omaha & Council Bluffs Electric Ry. Co. also proposes to build a bridge.

ELECTRICAL.

Electric Lighting.—***Portland, Me.***—The only bid received by T. P. SHAW, Chairman of the Committee on Lamps, was from the company which has the contract now, and at the same price.

Boston, Mass.—The following bids were received by GEO. H. ALLEN, Superintendent of Lamps, on Nov. 29: Boston Electric Light Co.; 65, 55 or 50 cts. per light per night for 1, 3 or 5 years, for the districts of the city proper, East Boston, South Boston, Roxbury, West Roxbury and Dorchester. Charlestown Gas Co., Charlestown, Mass., 65, 55, and 50 cts. for the Charlestown district. Brookline Gas Light Co., Brookline, Mass., 57, 53 and 50 cts. for the Brighton district. Suburban Light & Power Co., Boston, 49, 47 and 45 cts. for Roxbury, West Roxbury and Dorchester districts.

Windsor Locks, Conn.—The Windsor Locks Electric Light Co. has been organized and will put in its plant at once. President, E. B. BAILEY; Vice-President, J. R. MONTGOMERY; Secretary, H. C. DOUGLAS.

Attica, N. Y.—The Attica Electric Light Co. has been incorporated. Capital stock, $20,000.

Port Richmond, N. Y.—The Staten Island Electric Co. has been organized and has been awarded a contract. President, CALVIN DETRICK, 47 Broadway, N. Y.

Columbus, Ind.—The City Council has contracted with the Keystone Construction Co. for an electric light plant for street lighting. Injunction proceedings have been served on the Council and on the other city officers by the Columbus Gas Light & Coke Co. and Citizens' Electric Light Co. to prevent them from purchasing or installing the plant.

Wabash, Ind.—The system of lighting by arc lights on towers, which was first used in this town, has been displaced by the Heisler incandescent system.

Marquette, Mich.—The electric light plant, owned by the city, has been put in operation. Water power at Bead River Falls, 3 miles distant, is utilized, and the entire cost of the plant, including 400 acres of land along Bead River, and embracing several other fine powers, will be about $50,000. The plant operates 60 street lamps of 2,000 c. p. each.

Chicago, Ill.—The Park Ridge Arc Light & Power Co. has been incorporated by F. B. CLARK, M. T. CAHILL and EDWARD STACK. Capital stock, $50,000.

Evanston, Ill.—The Evanston Electric Illuminating Co. has been incorporated by C. A. BYRNE, L. L SMITH, and S. C. ABBOTT. Capital stock, $50,000.

Brighton, Ill.—The New Brighton Electric Light & Power Co. has been incorporated by P. W. ABT, M. BENZENE, and T. L. FEKATE. Capital stock, $20,000.

Dixon, Ill. — The Dixon Electric Light & Power Co. has been incorporated by F. A. WATSON, I. B. COUNTRYMAN, and J. B PLUMMER. Capital stock, $15,000.

Holden, Mo.— The Holden Water Co. has a franchise for electric lighting and will put in the Heisler long distance system.

La Grande, Ore.—The La Grande Edison Electric Co. has been organized. President, W. H. MCDONALD; Vice-President, H. ANSEN; Manager, J. K. ROMING. The contract for the plant has been let to Purdum & Kerr for $13,500. The plant will have a capacity for lighting 800 16 c. p. Edison incandescent lamps. The motive power will consist of two Edison dynamos driven by a 50 H. P. Ball automatic engine, with a 60 H. P. horizontal tubular boiler made by the Ball Mfg. Co.

San Francisco, Cal.—The San Francisco Electric Light & Power Co. has been incorporated by MARTIN BULGER, ROB'T P. HASTINGS, WM. MCMANN, J. M. CHENOWITH, W. C. CLARK, H. G. PLATT, and J. S. HUMBIRD, of Pittsburg, Pa. Capital stock, $1,000,000.

Mexico.—Mr. THEO. PLATE, President of the Interstate Gas & Water Works Co., of St. Louis, Mo., has secured franchises extending over long terms of years, for erecting and operating incandescent electric light plants in the cities of Durango and Aguas Calientes. The franchises are accompanied with contracts for lighting the streets and other public places. In Durango, the authorities use 200 32 c. p. lights and 150 16 c. p. lights, and at Aguas Calientes, 150 32 c. p. lights and 175 16 c. p. lights. These lights are to be operated about 240 hours per month. The Heisler system of long distance incandescent lighting has been adopted, and orders have been placed with the St. Louis office of the company for complete outfits of central station apparatus. On account of the high cost of fuel, compound condensing high-speed engines will be used. Mr. PLATE and his engineer, Mr. ANDREWS, have left for Mexico.

Underground Wires.—The Essex Subway Co. has been incorporated by PHILIP N. JACKSON, DAVID YOUNG, HENRY M. DOREMUS, J. FRANK FORT, BENJAMIN W. HOFFER, SAMUEL KLOTZ, MICHAEL T. BARRETT and JAMES SMITH, JR., of Newark, N. J. The purpose is to adopt some practical system for putting all lighting, power, telegraph and telephone wires under-ground, and a composition of wood pulp is being considered. There is no expectation of applying the conduit for electric car purposes.

SEWERAGE AND MUNICIPAL.

Street Work.—***Denver, Col.***—Arrangements having been made for paving several streets, the Board of Public Works has passed a resolution providing that water and gas pipes, etc., must be laid before May. 1890.—— The property owners on 15th and 16th Sts. have decided in favor of asphalt paving.

Key West, Fla.—Bonds have been issued for grading, paving and street improvement.

Sewers.—***Cumberland Mills, Me.***—A sewerage system is being put in by S. D. Warren & Co.

Fairfield, Me.—A sewerage system is needed, and its construction is now contemplated.

Brooklyn, N. Y.—The North 2nd St. relief sewer has been completed It is built of brick and Rosendale cement, is egg-shaped in section, 4 ft. 2 ins. wide by 6 ft. 3 ins. high, and cost $100,000. The contractors, Bray & Gillen, commenced work in July, 1888. Capt. DAVID BROWER was the engineer in charge.

Newark, N. J.—A trunk sewer is proposed for the drainage of a part of East Orange and annexations of Clinton and East Orange townships to Newark. The cost will be about $100,000.

Key West, Fla.—Bonds have been issued for a system of sewerage. For particulars address the mayor.

Decatur, Ill.—The Council has decided to build 6 ft. brick sewers to cost $125,000, to be paid for by special assessment and general taxation.

Ogden, Utah.—It is probable that the City Council will decide to appoint a sewerage commission to make a thorough investigation of the sewerage question, and recommend to the Council the extent and kind of a system, which in the judgment of the commissioners is found to be the best suited for this city.

Galveston, Tex.—Plans are being prepared for a system of sewers. For particulars address the Mayor.

Drainage.—***Louisiana.***—Mr. J. B. WATKINS, of Lake Charles, recently visited Holland to investigate the drainage system in that country, and is said to be of opinion that the best thing that can be done for the marsh lands of southwestern Louisiana is to import the best class of Hollanders to Louisiana and give them charge of these lands.

Sewage Pump.—The Salt Lake City, Utah, Council Committee on Sewerage has decided to put in a 30 H. P., standard Sprague electric motor with which to run the sewage pump at the sump, and will buy the same from the Utah & Montana Machinery Co.; the City Railway Co. will furnish the motive power from its wires. The committee has decided also to set up a boiler and steam engine for use in case of accident to the electric plant, and will use a good second-hand steam plant now within reach.

Gas Lighting.—At Red Oak, Ia., pending the putting in of an electric light plant, the City Council has voted to contract with the gas company for lighting the streets by gas. The cost is $1.75 per lamp per month.

WATER-WORKS.

NEW ENGLAND.

Sullivan, Me.—CHARLES P. SIMPSON has sent us the following information:

The construction of works has been deferred to next year in order to secure more money, and put in better works. It is the intention to establish a system as soon as sufficient means can be procured.

Ellsworth, Me.—A. W. CUSHMAN informs us that the new works will be completed about Dec. 10.

Bethel, Me.—We have received the following information from GEO. H. BROWN:

The estimated cost of the new works is $35,000. They will be built by the city. The proposed source of supply is Chapman Brook. Chairman Water Board, W. E. SKILLINGS, Engineer in charge of surveys, W. PHILBROOK. Population, 3,000.

We have received another report stating that the works will be built by the Bethel Water Co, at an estimated cost of $25,000 to $30,000. The supply to be conveyed from Chapman Brook, by gravity. Contracts to be let this winter, and work begun next spring. A. E. HENRICK may be addressed for further information.

Eastport, Me.—We are informed that improvements are contemplated to the amount of $50,000.

Berlin Falls, N. H.—We are indebted to LEWIS N. CLARK for the following information:

The Berlin Aqueduct Co. contemplates building works to cost $50,000. The officers are: H. H. FARRISH, LEWIS N. CLARK and D. GREENE. Designing and Constructing Engineer, C. E. JORDAN, of Portland, Me. Engineer in charge of surveys, W. C. PERKINS. The proposed source of supply is mountain streams. Estimated cost, $50,000. Contracts will probably be let in May, 1890. Population, about 9,000.

Tilton, N. H.—A correspondent informs us that steps are being taken to secure the water supply from Forest Pond, located in the northern part of Canterbury.

Exeter, N. H.—Considerable damage is reported to have been done to the pumping station, boiler house, and filtering plant, by the recent heavy storms.

Wolfborough, N. H.—C. F. PIPER informs us that the new works will be completed about Jan. 1, 1890. Water is conveyed from Beach Pond, 400 ft. above the town, by gravity, to a reservoir of 250,000 galls. capacity, constructed by F. R. Page, of Malden, Mass. There are 9 miles of cast-iron pipe, furnished by the McNeal Pipe & Foundry Co., of Burlington, N. J., and laid by F. A. Snow, of Providence, R. I. Estimated cost, $45,000. The Designing Engineer was J. A. FARRINGTON, of Portsmouth, N. H. Constructing Engineer, J. F. SPRINGFIELD, of Rochester, N. Y. Population, 3,000.

Northwood Narrows, N. H.—The following is from O. M. JAMES:

Preliminary surveys for a system of works are being made by O. M. JAMES. The proposed source of supply is Jenness Lake, 1½ miles distant. It has not been decided whether the town will build them or grant a franchise to a company. The estimated cost of the works is $10,000. The present supply is from wells. Population, 500.

Poultney, Vt.—M. J. HORTON, Chairman of the Water Board has sent us the following:

The new works were to be completed on Nov. 25. Work was begun on Sept. 3. The supply is taken from a reservoir located in Hampton, N. Y., 1½ miles from town. The contractor was Adam Miller, of Saratoga Springs, N. Y. Pipe and specials were furnished by the Warren Foundry & Machine Co., of Phillipsburg, N. J. Valves and hydrants by the Ludlow Valve Mfg. Co., of Troy, N. Y. Estimated cost, $30,000. Engineer, D. M. GREEN, of Troy, N. Y. Population, 1,500.

Salem, Mass.—The following bids have been received for furnishing the pipe for the new 30 in. main: Meilert Foundry & Machine Co., of Reading, Pa., $31.50 per ton; Gloucester, N. J., Iron Works, $28.79; Warren Foundry & Machine Co., of Phillipsburg, N. J., $28.40; McNeal Pipe & Foundry Co., Burlington, N. J., $27.50; The contract was awarded to R. D. Wood & Co., of Philadelphia, at $26.98 per ton.——An additional appropriation of $36,000 has been made by the City Council.

Newton, Mass.—The action of the City Treasurer in accepting the bid of Blake Bros. & Co., for the $40,000 of new water bonds has been ratified by the City Council.

Springfield, Mass.—The Water Commissioners have received a proposition to supply the city with 5,000,000 galls. of pure water daily, the party agreeing to establish works at his own expense, and asking no pay for same until the scheme has proved successful. His plan is to sink several wells on the plain, a short distance from the city.

Avon, Mass.—The new works will probably be completed before Jan. 1, 1890. They will be owned by the town. L. E. HAWES, of Boston is the Engineer. Estimated cost, $45,000.

Leicester, Mass.—Works are being built. FRANK L. FULLER, of Boston, is the Engineer.

Reading, Mass.—We are indebted to H. G. KITTREDGE, of Reading, Editor of the Boston *Journal of Commerce*, for the following information:

The members of the recently appointed Board of Water Commissioners are: LEWIS M. BANCROFT, Chairman, GEO. E. ABBOTT, Secretary, and ED. C. NICHOLS. They have been instructed to employ an engineer to make preliminary surveys and estimates, and report. M. M. TIDD, of Boston, has looked over the ground for a source of supply, and is expected to report soon. The proposed plan is to pump water from driven wells to a stand-pipe. Contracts will probably be let early in 1890, and work commence in the spring. Estimated cost, $100 000. The population is 3,700.

Meriden, Conn.—T. H. MCKENZIE has been engaged to report on a plan for remodeling the old works and increasing the supply.

Litchfield, Conn.—Pipe laying has been commenced, as well as work on the dam.

MIDDLE.

Tarrytown, N. Y.—It is reported that $50,000 will be expended this season in improving the water and electric light works.

Brooklyn, N. Y.—Sealed proposals will be received by JOHN P. ADAMS, Commissioner of Public Works, until Dec. 30, for three 10,000,000-gall. compound engines, with boilers, and one 4,000,000-gall. compound engine and boiler, to be erected at the Milburn Pumping Station. Water is to be delivered into the reservoir through a 48-in. force main about 7,000 ft. long in length. Specifications and all necessary information will be furnished upon application.

Rochester, N. Y.—An analysis of the water in Hemlock and Ontario lakes has been made by Prof. S. A. LATTIMORE, which shows the water in the former to be the purer. The special committee appointed by the City Council, also reported in favor of Hemlock Lake as the source for the new supply.

They also recommend that an act be immediately prepared and presented during the first days of the session of the next Legislature, authorizing the city to raise $1,500,000 for the construction of the works.

Cohoes, N. Y.—The City Engineer has submitted his report of the cost of making the proposed extensions, and estimates the total expense at $19,210.

Amsterdam, N. Y.—Bids will be received until Dec. 10, by JAMES R. SNELL, President of the Board of Water

Commissioners, for constructing Hans Creek conduit. For details see advertisement under proposals open.

Asbury Park, N. J.—The Monmouth Water Co. has purchased the Remsen Mill property, about two miles distant, including a stream capable of flowing 10,000,000 galls. per day, from which water will be pumped into a reservoir to be erected on Sugar Loaf Hill, 125 ft. above sea level.

The company intends to lay pipe as far north as Elberon and as far south as Manasquan, and furnish water to the following towns: Elberon, Deal, Loch Auburn, Interlaken, West Asbury Park, West Ocean Grove, Bradley Beach, Ocean Park, Neptune City, Avon-by-the-Sea, Belmar, West Ocean Beach, Lake Como, North Spring Lake, Spring Lake, Villa Park, West Spring Lake, Sea Girt, Manasquan and the State Encampment Ground.

East Stroudsburg, Pa.—New works are to be constructed. The Town Council has decided to issue $38,500 of 5 per cent. bonds.

Annville, Pa.—H. ZIMMERMAN, Secretary of the water company sends us the following information:

There are two companies by the same name in town and it has not been decided which one, or whether both, will construct works. The proposed plan is to convey the supply from springs to a tank by gravity. Estimated cost, $20,000. No engineer has been secured. Contracts will probably be let about Jan. 1, 1890. Population, 1,800.

Kingston, Pa.—We have received the following information from ABRAM NESBITT, Treasurer:

The company was organized several years ago, and has been operating on a small scale. The plant is to be enlarged to supply 100,000 inhabitants, and several miles of new mains are being added. The company has a capital stock of $100,000, and has issued $300,000 of bonds. President, L. D. SHOEMAKER; Secretary, L. A. WATERS Treasurer, ABRAM NESBITT. Engineer, C. T. REETS.

SOUTHERN.

Richmond, Va.—A considerable amount of 6-in pipe has been ordered laid.

Blowing Rock, N. C.—It is reported that new works are to be constructed, and that machinery and supplies will soon be wanted. Address J. B. CLARKE, Mayor.

Anderson, S. C.—The Anderson Water-Works Co. has been organized. It is reported that the contract has been let to Roddy & Whitner, of Rock Hill.

Way Cross, Ga.—Ways and means for establishing works are being discussed.

Lexington, Ga.—A stock company is being formed to build works. The proposed plan is to erect a 10,000-gall. tank near the Terminal depot at such a height as will secure sufficient pressure to deliver water for fire protection and domestic supply. Hydrants will be used.

Albany, Ga.—The question of constructing works was voted upon on December 2.

Chattanooga, Tenn.—The foundation of the City Water Co.'s Ridgedale reservoir gave way on Nov 25, and the escaping water destroyed the spring from which the citizens of Ridgedale secure their supply. It is reported as probable that a new reservoir will have to be constructed.

Fayetteville, Tenn.—We have received the following information from W. O. MORGAN:

The question of the city building works, or letting the contract is now under consideration. It is proposed to pump water from Elk River. No engineer has been employed, and no definite steps taken. It is proposed to begin work soon. Population, 2,500.

Richmond, Ky.—It is reported that J. H. Mead is negotiating to build the works.

Lexington, Ky.—It is reported that Superintendent S. A. CHARLES, has prepared plans and estimates for the enlargement of the works.

NORTH CENTRAL.

Bridgeport, O.—The question of constructing works is again being agitated, and a committee has been appointed. [In June ROSS J. ALEXANDER informed us that it was proposed to build works to connect with those at Wheeling or Martin's Ferry, at an estimated cost of $25,000. Also that GEO. A. MCKEE could be addressed for information.—ED.]

Van Wert, O.—The Mayor has appointed the following Water-Works Trustees, who are to superintend the construction of the works: H. BUTLER, W. C. BROOKS, A. B. GLEASON, and W. B. JONES.

Miamisburgh, O.—It is reported that a reservoir, costing $50,000, is to be constructed, and that JOHN W. HILL, of Cincinnati, O., is the Engineer.

Toronto, O.—Sealed proposals will be received until Jan. 2, 1890, for constructing a system of works in, and adjacent to, Toronto, in accordance with plans and specifications now on file. J. D. COOK, of Toledo, O., is Consulting Engineer. President Water Commissioners, W. B. GOUCHER.—[We repeat this notice to correct error in note published last week stating bids would be received until Dec. 4.—ED.]

Jeffersonville, Ind.—The Ohio Falls Car Works is to be supplied with water from the company's plant.

Howard City, Mich.—At a recent election, a large majority vote was cast in favor of establishing works. Work will be commenced at once.

Elk Rapids, Mich.—Works will be established in the spring.

Coldwater, Mich.—A committee of six has been appointed to prepare plans and secure estimates for a system of works. Members of the committee are: Mayor ALLEN, L. M. WING, E. R. CLARKE, GEO. STARR, and Aldermen ALLEN and VAN BLARCUM. An election will be held in the spring to vote on the question of issuing bonds.

Fenton, Mich.—CHAS. M. TOPPING, Clerk, sends us the following information:

Works are being built by M. Walker, for the town. The estimated cost is $25,000, procured by 5 per cent. town bonds. The supply is taken from wells. Work was begun Nov. 1, and is to be completed by April 1, 1890. The population is 2,000.

Pekin, Ill.—Additional distribution mains are to be laid.

Cummings, Ill.—Arrangements are being made for extending the mains from the pumping station at 68th St., South Chicago, to supply the town with lake water.

Somonauk, Ill.—H. WRIGHT, Chairman Fire and Water Committee, has sent us the following:

The contract for complete works has been awarded to Clark & Co. Work was commenced Sept. 1, and is to be completed April 1, 1890. Water is to be pumped from a well to an 80,000-gall. reservoir. There will be two miles of 6-in. cast-iron mains, and 25 hydrants. Cost, $12,000. C. V. STEVENS is the Engineer.

Burlington, Wis.—Bids will soon be wanted for constructing a $20,000 system of works. W. F. GOODHUE, of Milwaukee, is the Engineer.

Kilbourn, Wis.—We have received the following information from C. W. SNIDER, President Water Board:

The contract has been let to G. M. MARSHAL for complete works, and work is well under way. The supply is to be pumped from a dug well to tanks. Estimated cost, $6,000; procured by bonds. Population, 1,100.

Rice Lake, Wis.—SEWELL A. PETERSON, City Clerk, sends us the following:

The Rice Lake Lumber Co. contemplates putting in works for their own use, and have talked of arranging to supply the town with water. No definite conclusions have as yet been reached. Population 2,500.

NORTHWEST

Sioux City, Ia.—A contract has been awarded to Louis Kettleson to sink 30 wells at 85 cts. per ft.

Excelsior, Minn.—It is reported that the town has voted to establish works.

St. Paul, Minn.—The City Engineer has been directed to investigate and report upon the advisability of building a special high service plant for Mount Curve, and other high districts in the city. The meter question is still being discussed.

Marshall, Minn.—We have received the following information from S. A. HARRINGTON:

Works are to be established, probably by the Northwestern Water Supply Co. No definite time has been set for their completion. Plans and specifications are now being prepared. The proposed plan is to pump water from an artesian well to a stand-pipe. Estimated cost, $20,000. Population, 1,500.

Baxter Springs, Kan.—The Baxter Springs Water Co. has been incorporated at Topeka with a capital stock of $40,000. The directors are: E. E. FRIZELE and W. S. PARK.

Seward, Neb.—The following information has been received from E. P. PHILLIPS:

Works are being built by the city, with A. A. RICHARDSON, of Lincoln, as Consulting Engineer. Work was begun Nov. 1, and will probably be completed by March 1, 1890. Water is pumped from wells to a stand-pipe, 12 ft. in diameter and 110 ft. high. There will be 3¼ miles of mains, and 48 hydrants. Estimated cost, $30,000; procured by 6 per cent bonds. The population is 2,500.

South Omaha, Neb.—Plans and specifications for a new settling basin, to be located in the western part of the city, are being prepared by County Surveyor BRODBECK.

Wymore, Neb.—The pumping machinery for the new works will be furnished by the Buffalo (N. Y.) Steam Pump Co.

Tyndall, Dak.—The new works have been completed.

Madison, Dak.—The town has voted to issue $10,000 of bonds for water-works.

SOUTHWESTERN.

Webb City, Mo.—JAS. K. MCNAVIN has sent us the following information:

Bids are now being received for constructing works. Estimated cost, $85,000; procured by city bonds. Water is to be pumped from wells to a stand-pipe. Address JAS. O'NEIL, President. Population, 4,000.

Wichita Falls, Tex.—It is reported that the town is negotiating with contractors for the construction of works.

Gonzales, Tex.—The Gonzales Water Power Co. has been incorporated to develop the water power of the Guadaloupe River by building a dam. The company proposes to furnish power for water-works and an electric light plant.

Cuero, Tex.—W. R. FREEMAN, of San Antonio, Engineer, informs us that work was begun Nov. 1, and is to be completed early next year. Guido Jaeger, of Rich Hill, Mo., is the contractor. Water will be pumped from the Guadaloupe River direct to a stand-pipe, 16 ft. in diameter by 105 ft. high. There will be 6 miles of mains, and 35 hydrants.

Denver, Col.—The Platte Water Co. has elected the following officers: President, Mayor LONDONER; Vice-President, Supervisor CLARK; Secretary, J. T. SMITH; Treasurer, A. B. PLACE.

PACIFIC.

Weston, Oregon.—P. A. WORTHINGTON informs us that the new works have been completed. Water is conveyed by gravity from springs to a reservoir of 115,000 galls. capacity. There are 3 miles of 6-in. pipe, furnished by the Puget Sound Pipe Co., of Olympia, Wash. Hydrants, 10. Cost, $9,500. Bonded debt, $10 000. Interest, 8 per cent.

Alameda, Cal.—The Alameda Water Co. has filed a claim to all the water flowing in Strawberry Creek, in the town of Berkeley within defined limits, and proposes to utilize the same for supplying Berkeley and other places with water. President, MOSES HOPKINS.

Nephi, Utah.—It is expected that the eastern part of the town will be supplied with water this winter.

Salt Lake City, Utah.—The City Council has caused notice to be published that a considerable amount of distribution pipe is soon to be laid.

Ogden, Utah.—The Jarvis-Conklin Mortgage Trust Co., of New York, is now offering $500,000 of 7 per cent, 20 year gold bonds, of the Bear Lake & River Water-Works & Irrigation Co. for sale at par.

CANADA.

Galt, Ont.—Bids will be received until Dec. 26, for supplying the town with water for fire protection and domestic use. Proposals would also be received for establishing works on the franchise plan. Address ADAM CRANSTON, Chairman Water-Works Committee.

London, Ont.—The City Engineer has been directed to furnish an estimate of the cost of obtaining the extra water supply, and the extension of mains therein for a period of five years, also for laying mains to, and in, South London.

Chatham, Ont.—We are indebted to Hinds & Bond Engineers and Contractors, of Watertown, N. Y., for the following information:

The city granted a franchise to Hinds & Bond for constructing works some time ago. Later, the Chatham Water-Works Co. was organized by the same parties, and a contract signed with them by the city. All communications concerning these works should be addressed to Hinds & Bond, of Watertown, N. Y. [In our issue of Nov. 16 we stated the city had contracted with the Drive Well Water-Works Co. The above information has been kindly sent to us to correct the error.—ED.]

Neepawa, Manitoba.—The question of fire protection, is being discussed, and two additional tanks are to be erected in Hamilton St.

Winnipeg, Manitoba.—Bids will be received until Dec. 9 for constructing the Assiniboine water-power works in accordance with plans and specifications prepared by City Engineer RUTTAN.

Vancouver, B. C.—The Capilano Water Co. is making arrangements to lay a duplicate pipe line across the Narrows.

New Westminster, B. C.—Sealed proposals will be received by the City Clerk until Jan. 15, 1890, for constructing a complete system of water-works. Specifications and full particulars can be obtained from ARTHUR HILL, Water-Works Engineer. W. H. KEARY is Chairman the Water Commission.

ARTESIAN WELLS.

Hitchcock, Dak.—A syndicate is to be formed to sink another well.

Grand Forks, N. Dak.—A flow of 1,000 barrels of water per hour is being obtained from a 325-ft. well.

Louisville, Ky.—It is reported that the South Park Residence Co. is to sink a well, and construct a dam for the South Park Lake.

New Orleans, La.—The New Orleans Swamp Land Reclamation Company proposes to sink a number of artesian wells here to secure water for street sprinkling and other purposes. The company has investigated the matter and discovers that artesian wells are practicable and inexpensive, that water of excellent quality can be struck at a depth of from 680 to 720 ft. and a flow of 40,000 to 50,000 galls. obtained. The cost of sinking the pipes is only $750 to $1,200. The pipes will be sunk under the Kells system, only one pipe being used, instead of a multiplicity of pipes as in other cities. The company will begin with $20,000 capital and is prepared to place wells in every block, if ten householders will guarantee $10 a year rent.

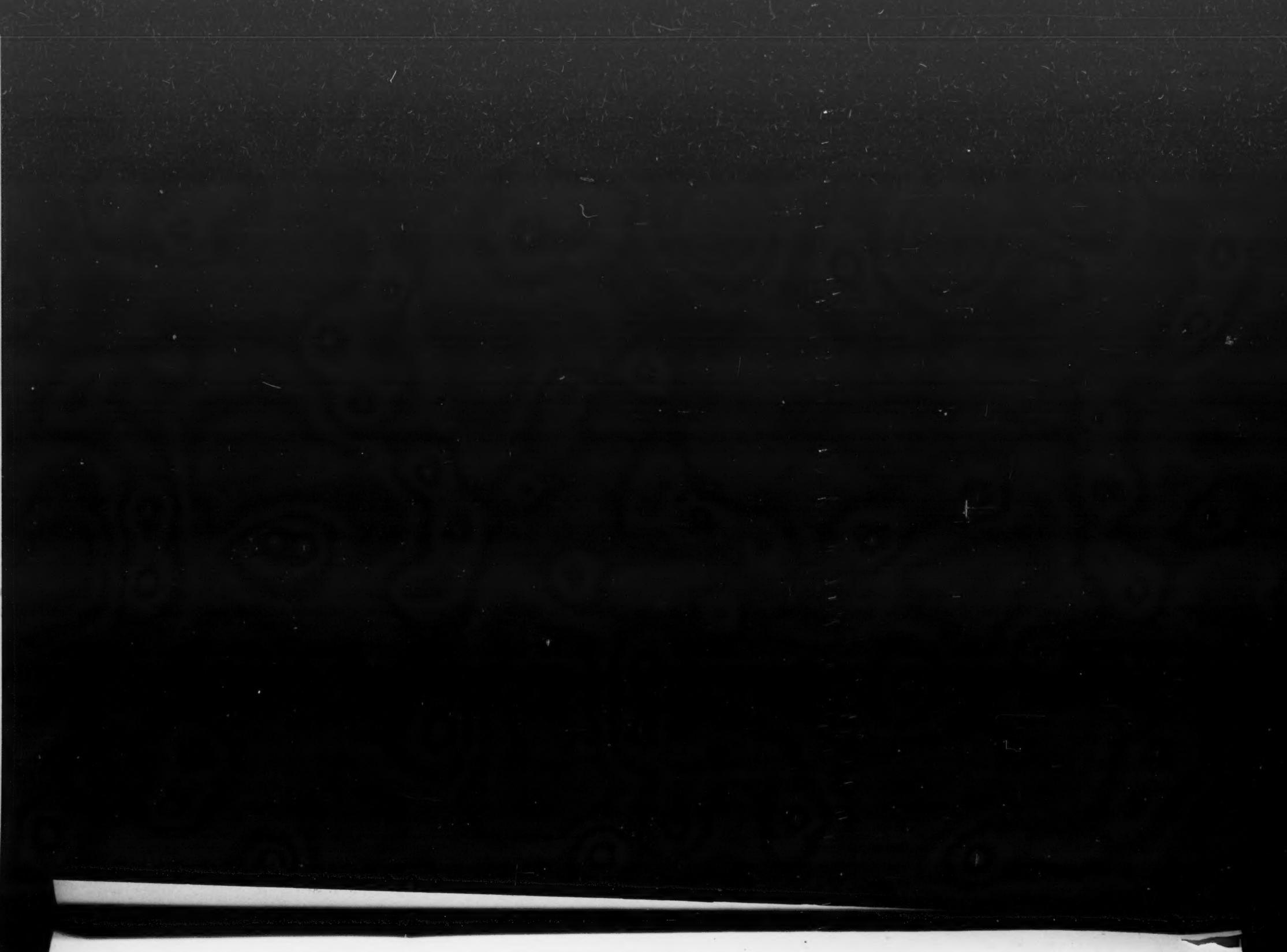
San Marcial, N. M.—W. L. HOLMES has been awarded the contract for sinking two wells: one at the base of the San Andrews mountains; the other near Laval.

IRRIGATION.

Delano, Cal.—The citizens have voted in favor of forming a 75,000 acre irrigation district.

Dakota.—Thirty miles of the Redwater canal is to be completed by March 1, 1890.

Greeley, Col.—The Irrigation Pump Co. has recently shipped 19 pumps to California. They have also shipped one to Louisiana, and have received an order for one from Mexico.

California.—The Owens River Canal, in Inyo County, will probably be completed by March 1, 1890. It is to be 38 miles long, and reclaim 30,000 acres.

Fresno, Cal.—An irrigation company has been formed under the Wright Law, embracing 200,000 acres near Selma and Kingsburg. The district includes the land through which the Fowler Switch, Centerville, Kingsburg, Emgrant and Liberty canals flow. These and other water rights will be purchased. Bonds to the amount of $250,000 will be issued.